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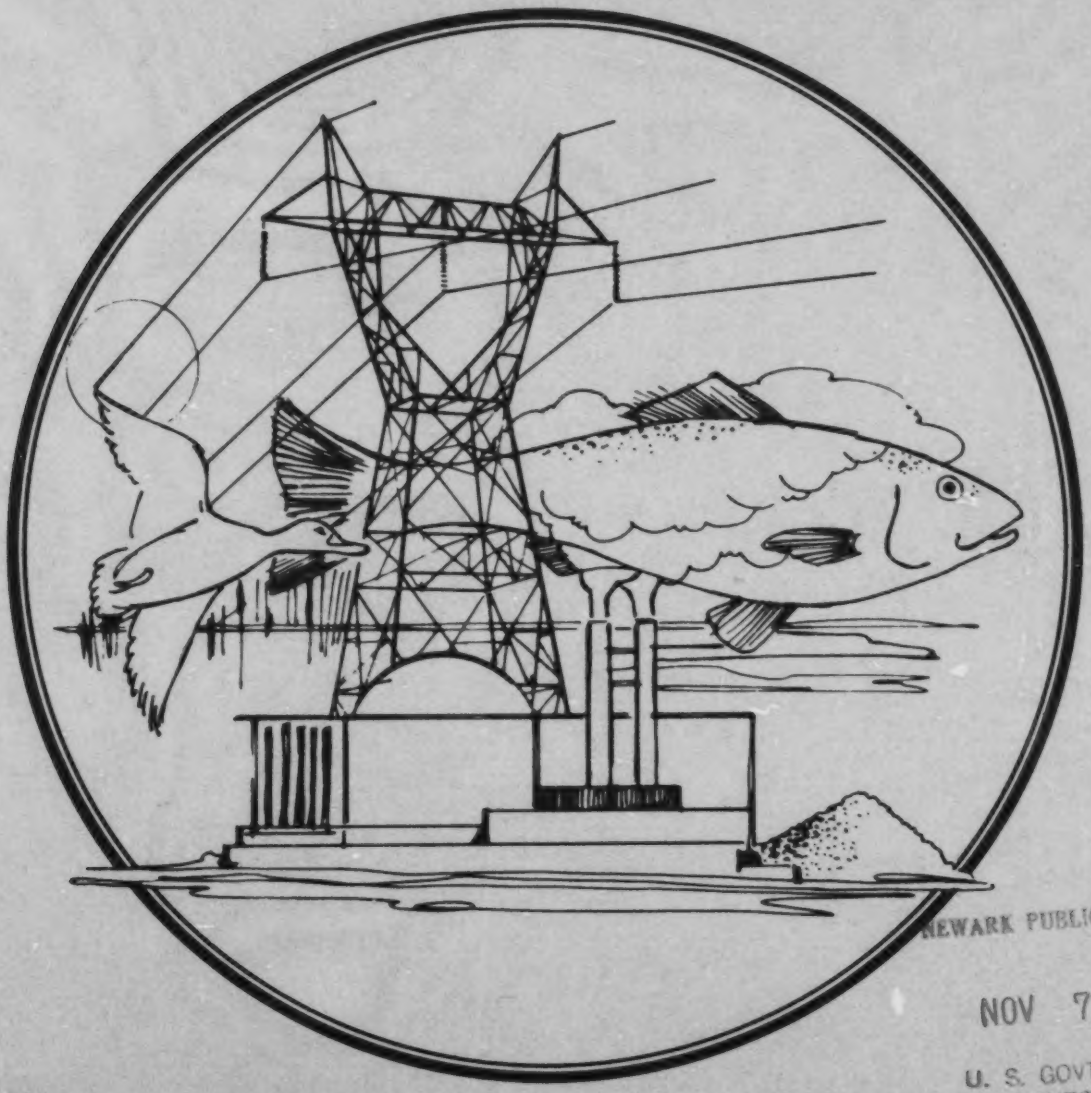
Avian Mortality at Man-made Structures: An Annotated Bibliography (Revised)



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Biological Services Program

FWS/OBS-80/54
July 1980

AVIAN MORTALITY AT MAN-MADE STRUCTURES: AN ANNOTATED BIBLIOGRAPHY (REVISED)

by

Michael L. Avery
National Power Plant Team
U.S. Fish and Wildlife Service
2929 Plymouth Road
Ann Arbor, Michigan 48105

Paul F. Springer
Wildlife Research Field Station
U.S. Fish and Wildlife Service
Humboldt State University
Arcata, California 95521

Nancy S. Dailey
Ecological Sciences Information Center
Oak Ridge National Laboratory
Oak Ridge, Tennessee 37830

best copy available

Fish and Wildlife Service

U.S. Department of the Interior

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PREFACE

Because of the sustained interest on the subject of avian mortality at man-made structures and the continual acquisition of new references to the subject, a decision was made in 1979 to reissue the annotated bibliography first published in 1978 (FWS/OBS-78/55).

Rather than continue to distribute it in its original form, it was decided to revise and update the bibliography, correcting the errors contained in the original version, improving it according to users' comments, and incorporating the additional references that had been collected. The present edition is a compilation of 1042 references. The new references begin with number 854 and include 189 which were not in the original version. The literature review was completed in February 1980. Many of the new citations are unpublished reports or correspondence relating bird mortality information not previously published. The introduction and indexes of the bibliography have been revised to reflect the newly added references, and an author index has been added. Perhaps the most significant new entries are comprehensive reports concerning bird mortality at power lines in Oregon and Washington (Meyer 1978, James and Haak 1979) and in Holland (Heijnis 1976). These are indicative of a growing concern for avian collisions with overhead wires in the U.S. and elsewhere.

We appreciate the suggestions of many individuals who have used the bibliography, and we continue to solicit additional comments and references.

Suggestions or comments regarding the bibliography should be addressed to:

Information Transfer Specialist
U.S. Fish and Wildlife Service
National Power Plant Team
2929 Plymouth Road, Room 206
Ann Arbor, Michigan 48105

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INTRODUCTION

The adverse effects of man-made structures to birds in flight have long been recognized (e.g., Cooke 1888, Kumlien 1888); however, the proliferation in recent years of radio and TV towers, tall buildings, power lines, cooling towers, and tall stacks constitutes an increasing hazard to birds. Estimates of the annual mortality in the United States due to avian collisions with radio and TV towers range from 1 to 1.25 million (Mayfield 1967, Banks 1978), and losses due to strikes at windows and glass corridors probably exceed 80 million each year (Klem 1979). The effects of such mortality on species and populations are undetermined, but the growing public awareness of the need to respect our environment demands that proposed projects be evaluated beforehand as to the potential impacts on wildlife and their habitats and the means by which adverse impacts may be mitigated. To prepare a study, or to develop or assess an environmental impact statement, knowledge of related, previous work is essential. This bibliography will aid future investigators by providing a ready source of reference to past studies of bird mortality at man-made structures.

This project was originally conceived in 1972 during a study of bird losses associated with a 1200-foot navigational tower (Avery et al. 1975) when it was found that numerous references pertaining to avian mortality at man-made structures existed, but for the most part were not readily available. Thus, a systematic search was begun to prepare a comprehensive, annotated bibliography on the subject. Then, in September 1977, a further search was initiated by the Ecological Sciences Information Center at the Oak Ridge National Laboratory for the National Power Plant Team under an inter-agency agreement between the U.S. Fish and Wildlife Service and the Department of Energy. The results of these two efforts have been combined in this publication.

In addition, the Ecological Sciences Information Center maintains a computerized data base that includes this bibliography with extended abstracts. Specific fields available for searching include author, corporate author, sponsor, title, publicaton description, location (country, state, county, city, etc.), taxon, common name, family name or group (shorebirds, waterfowl, upland game birds, etc.), keywords, and subject category.

This bibliography is restricted to articles directly concerned with bird losses at man-made structures. Because of the large volume of literature involved, no attempt was made to include articles on related topics such as bird navigation and orientation, avian migration patterns and behavior, flight density and altitudinal distribution, and the effects of weather on migration. Similarly, articles concerning bird collisions with aircraft and vehicles are excluded. All of these subjects merit attention, but they were beyond the scope of this project.

The majority of the reports include the number of individuals and species killed, with some observations of weather conditions at the time of the incident, bird behavior near the structure, or comments on the attraction of birds to lights. Other reports use data derived from casualties to analyze migration routes and timing, examine the causes of death and injury, describe species morphometry and physiology, determine subspecific composition of migrant populations, and assess the impact of scavengers and predators on study reliability. Avian electrocution studies, which include both electric transmission structures and electric fences, report bird casualties, examine the circumstances causing death or injury, identify problem locations and lethal structural designs, and recommend design changes to reduce the hazard to birds.

This bibliography contains 1042 entries, 828 of which are from journals or periodicals of the United States (683), Canada (45), the British Isles (51), and elsewhere (49). The remaining references are from unpublished reports and correspondence (57), proceedings of conferences (38), government and private publications (33), books (33), utility company reports (32), theses (10), and newspapers (11). The majority of the references were located by manually searching the literature, particularly in the library of the Patuxent Wildlife Research Center, Laurel, Maryland and in the Bird Division Library and the Josselyn Van Tyne Memorial Library, Museum of Zoology, University of Michigan, Ann Arbor. Of the 91 American journals represented, American Birds (formerly Audubon Field Notes) was the greatest source of citations (246). These were primarily regional reports of the numbers of individuals and species killed during spring and fall migrations, or migration records obtained from kill incidents, with few details. Other journals contributing numerous references were the Auk (42), Condor (26), Migrant (50), and Wilson Bulletin (36). Wildlife Review (1952 to 1979) and Zoological Record (1921 to 1974) were searched to obtain some of the references, particularly foreign ones. The bibliographies of Buskirk (1967), Dailey (1978), Nisbet (1970), and Weir (1976b) provided additional citations. Foreign references were included when identified, but no attempt was made to conduct an exhaustive search of foreign literature. Computerized searches of the literature were performed at Oak Ridge National Laboratory (ORNL), Oak Ridge, Tennessee. Data bases (or systems) searched include BIOSIS (Biological Abstracts and Bioresearch Index), DOE Energy Data Base (Nuclear Science Abstracts), NTIS (Government Reports Announcements), Environmental Science Index, Water Resources Abstracts, and Enviroline. Additional information, most of it unpublished, was obtained through personal communications with interested parties.

Unless otherwise stated, each article was read, then summarized. The citation, summary (if given), and its source are provided for unobtained articles. Copies of all unpublished reports, and many of the published ones, are on file with the National Power Plant Team and/or the Ecological Sciences Information Center (ORNL). In the reference summaries, pertinent aspects of the articles are given, including the numbers of individuals and species killed, the principal species involved, date, location, weather conditions, and behavior of the birds. Included within some of

the summaries are cross-references to related articles. These references were not necessarily cited by the author, but are provided to facilitate access to articles pertaining to the same or a related incident. No attempt was made to include all possible cross-references. Unless otherwise stated, the year of the collision incident is the same as the year of the publication.

In general, the Style Manual of the Council of Biology Editors, 1972 edition, was followed throughout. Abbreviations of journal titles were taken from the 1977 BIOSIS List of Serials, and the abbreviations of states follow the Style Manual of the U.S. Government Printing Office, 1973 revised edition.

The citations are indexed according to subjects, kinds of birds, locations, and author. The subject categories are broad and include the types of structures involved and the major topics discussed in the articles. Birds mentioned in the abstracts are indexed according to their family (e.g., Warblers) or group (e.g., Shorebirds). The only individual species included in the index are those listed as threatened or endangered by the U.S. Department of the Interior (27 October 1976, Federal Register 41(208):47181-47198). Common names of birds mentioned in articles from the U.S. and Canada have been made consistent with the American Ornithologists' Union Checklist of North American Birds, 1957 edition, and supplements. Common names of birds outside North America were not changed from the authors' original usage. Incidents within the United States are indexed by State within U.S. Fish and Wildlife Service regional boundaries (see map) and incidents outside this country are entered under Africa, Asia, Australia and New Zealand, British Isles, Canada, Europe, Pacific Islands, and South America and the West Indies.

In Tables 1 and 2, aspects of the geographic and temporal distributions of bird mortality references are summarized. Data in Table 2 are restricted to North American journal articles because our coverage has been most complete in that area; in Table 1, all classes of reports are tabulated. Despite the many references concerning collision mortality in birds, the coverage in reporting of losses has been uneven and the data in Tables 1 and 2 must be evaluated carefully. The reported incidents are more likely representative of the distribution of interested workers than of the actual occurrence of avian mortality at man-made structures.

Virtually nonexistent outside of North America (Table 1), reports of kills at fixed beam airport ceilometers and radio and TV towers began to dominate the literature on avian collision mortality in the early 1950's (Table 2). The large single-night kills associated with these facilities attracted attention throughout the eastern half of the continent. The ceilometer problem was essentially restricted to the 1950's and early 1960's because improved technology resulted in the eventual replacement of fixed beam ceilometers with rotating beam types that proved to be no hazard to birds. Reports of incidents at tall towers increased through the 1950's and 1960's as more of these structures were built and as

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Table 1. Geographic distribution of references to bird mortality through collisions with selected types of structures.

Type of structure	Location					
	U.S.	Canada	British Isles	Europe	Elsewhere	Total
Towers	345	38	0	1	5	389
Ceilometers	66	0	0	0	0	66
Lighthouses	35	30	20	6	7	98
Stacks	6	19	0	0	0	25
Buildings	108	10	8	11	6	143
Overhead wires	71	6	12	9	7	105
Total	631	103	40	27	25	826

public interest grew. But in the 1970's, the number of published reports dropped off somewhat, perhaps due to a decrease in the number of incidents, but more likely because of shifting public interest which simply resulted in fewer kills being reported.

Coincident with the decline in tower mortality reports from the 1960's to the 1970's were increases in the numbers of published articles reporting losses at buildings and windows, smoke stacks, and overhead wires (Table 2). Buildings and windows are the single source of mortality most often reported in Europe (Table 1), and in North America the number

Table 2. The number of North American journal articles reporting avian collision mortality at various types of structures since 1870.

Decade	Type of structure						
	Towers	Ceilometers	Lighthouses	Stacks	Buildings	Wires	Total
1870-79	0	0	0	0	0	2	2
1880-89	0	0	8	0	1	0	9
1890-99	0	0	0	0	1	3	4
1900-09	0	0	6	0	5	1	12
1910-19	0	0	1	0	1	4	6
1920-29	0	0	6	1	5	4	16
1930-39	0	0	4	0	1	2	7
1940-49	2	3	1	0	4	4	14
1950-59	53	41	3	0	16	7	120
1960-69	150	13	18	0	19	4	204
1970-79	140	0	11	20	32	18	221
Total	345	57	58	21	85	49	615

of reports has increased steadily since the 1940's. Only recently have tall stacks, usually associated with power generating stations, been prominent in bird mortality reports. Most of the articles in this category represented in Table 2 concern bird losses at two power plants in Ontario (Weir 1972 et seq.). Wire strikes were first recorded in North America over 100 years ago (Coues 1876, Aldrich 1877), but only now is this mortality source receiving much attention in published journal articles (Table 2). The growing concern over these types of losses is corroborated by the recent spate of studies (reviewed by Gauthreaux 1978b) on this topic and by a workshop sponsored by the U.S. Fish and Wildlife Service and Oak Ridge Associated Universities during 31 January-2 February 1978 (Avery, ed. 1978). To date no effective measures have been developed in the U.S. to prevent bird collisions at power lines although the techniques devised to reduce the electrocution hazard (Miller et al. 1975) illustrate that problems of this nature are amenable to solution.

Lighthouses and light vessels represent the remaining major category of structures associated with avian collision mortality. These structures have comprised a relatively small portion of the reports from the U.S. compared to other parts of the world (Table 1). The number of published articles on lighthouse collisions in North America varied slightly through the 1950's, rose abruptly in the 1960's, and declined in the 1970's (Table 2).

A long-term, coordinated, national or regional effort to monitor and report bird losses at man-made structures is long overdue. The 3-year study in Ontario by Baldwin (1962, 1963, 1965) and his associates was an effort toward this end. Until a thorough, comprehensive survey is made, it will be impossible to fully assess the impact of man-made structures on bird populations.

We appreciate the help of the following librarians in obtaining many of the references included in this bibliography: Nancy Ann Dorgan and Eileen Bartels of the Northern Prairie Wildlife Research Center; Ell-Piret Multer of the Denver Wildlife Research Center; Carole Koehmstedt of North Dakota State University; Lynda Garrett and Ceil Nalley of the Patuxent Wildlife Research Center; Kathy Gilden and Hillary Handwerger of the National Power Plant Team; and Opal Russell of the Oak Ridge National Laboratory. Betty Cornett of ORNL assisted with the computer search and acquisition of documents. Susan Richardson of the Information Sciences and Operations Department, ORNL, carried out the computer production of the data base.

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Despite the work expended in compiling this bibliography, there are recognized deficiencies. It will be appreciated if any omissions or errors, as well as future references, are brought to the authors' attention.

BIBLIOGRAPHY

1. Able, K.P. 1963. Television tower mortality in the Niagara frontier during fall, 1962. Kingbird 13(4):192-195.

A summary of 682 losses (43 species) at a 1076-foot tower at Colden, N.Y. is given. It is speculated that, due to superior eyesight, rails and shorebirds do not suffer great losses at towers. Weather data are provided.

2. _____. 1966. Television tower mortality near Louisville. Ky. Warbler 42(2):27-28.

Five small kills totalling 25 birds of 16 species occurred at a 973-foot tower during fall 1965 in association with low pressure systems and frontal activity.

3. _____. 1972. The changing seasons. Am. Birds 26(1):25-30.

In fall 1971, tower kills were reported from western New York and in the southeast U.S. No details are given.

4. _____. 1973. The changing seasons. Am. Birds 27(1):19-23.

In fall 1972, single night kills exceeding 1000 birds occurred at TV towers in Tennessee and Florida, and twice at the floodlit chimneys of a Lennox, Ont. power plant.

5. Adams, D.A. 1962. Nocturnal migrant mortality in the Carolinas, September 1962. Chat 26(4):83-88.

Mortality at four towers and two ceilometers during 6-8 September is discussed, and a list, by location, of 4189 birds of 61 species is given. Three species - Red-eyed Vireo, Ovenbird, American Redstart - comprised two-thirds of the total kill.

6. Aldrich, J.W., R.R. Graber, D.A. Munro, G.J. Wallace, G.C. West, and V.H. Cahalane. 1966. Report of committee on bird protection. Auk 83(3):465-467.

This report is a brief overview of bird mortality at towers and ceilometers and an appeal for more research into its causes and effects. In the last 10 years, about 300,000 casualties have been reported and the problem may worsen as tall towers become more numerous.

7. Allen, J.A. 1880. Destruction of birds by lighthouses. Nuttall Ornithol. Club Bull. 5(3):131-138.

Reports form 24 lighthouses in the U.S. are presented. Greatest losses occurred at lights in the Carolinas, Florida and Louisiana, and lesser mortality was reported from the northeast. Two lights in San Fancisco Bay reported no losses.

8. _____. 1901. Review of Barrington's 'The migration of birds at Irish light stations'. Auk 18(2):205-206.

This is a review of Barrington's (1900) book.

9. Alsop, F.J., III, and G.O. Wallace. 1969. Spring tower-kill in Knox County. Migrant 40(3):57-58.

Twenty casualties (10 species) were collected at the WTKV tower in Tennessee following the night of 7-8 May. A list of the losses is given with weight, length, wing, tail, bill tarsus and gonadal measurements. Weather data are also included.

10. Andersen-Harild, P., and D. Bloch. 1973. En forelobig undersogelse over fugle draebt mod elledninger. (Birds killed by overhead wires on some locations in Denmark) [in Danish, English summary]. Dan. Ornithol. Foren. Tidsskr. 67(1-2):15-23.

During 3-22 October 1971, bird losses were monitored along 13.1 km of power lines (60 kV and 150 kV) and smaller overhead wires at four locations in Denmark. Most of the lines were in reed beds or shallow water areas. Checks for casualties were made daily at daybreak. Of the 105 casualties, 80% were found within 5 m of the wires. The configuration of the conductor system is an important factor in the extent of the mortality at a particular site. The most lethal of the four sites studied had a "wall of wires" configuration

(12 wires at 8 different levels) and averaged nine dead birds recovered per 24 hours per 10 km of power line. About 60% of the total losses were of species resting in the area (herons, ducks, shorebirds, gulls) and 40% were night migrants (Moorhens, owls, thrushes, Starlings, songbirds). The number and type of birds killed at a site depends on local factors such as the composition of the birds in the area. In this study, swans, gulls, and certain shorebirds were particularly vulnerable but ducks were killed in relatively low numbers. One species of bittern that was killed, Botaurus stellaris, is threatened by extermination in Denmark. The authors conclude that overhead wire systems should be regarded "as a part of the correlation of environmental factors which have a negative effect on bird populations. . . ." (From English summary.)

11. Anderson, A. H. 1933. Electrocution of Purple Martins. Condor 35:204.

In early June 1933, two martins were killed at a 2.3 kV power line near Tucson, Ariz.

12. Anderson, W. L. 1978. Waterfowl collisions with power lines at a coal-fired power plant. Wildl. Soc. Bull. 6(2):77-83.

An estimated 400 birds per fall season (0.4% of the peak number present) were killed by colliding with overhead power lines at the Lake Sangchris-Kincaid, Ill. power plant during 1973-75. Blue-winged Teal were the most vulnerable and Mallards the least vulnerable to collisions. Factors believed to be responsible for losses here include: the number of birds present, the visibility of the lines, the occurrence of disturbances that startle birds into flight, the species present, and the degree of familiarity of the birds with the area. To reduce losses, it is recommended that lines not be built over water, that lines not cross places where waterfowl are known to congregate, that the visibility of lines be enhanced, and that waterfowl not be disturbed in the vicinity of overhead lines.

13. Andrle, R. F. 1971. The month. Prothonotary 37(9):117.

On 29 and 31 August, 313 birds (26 species) were collected at five towers in the Buffalo, N.Y. area.

14. Anonymous. 1902. Birds that struck the city hall tower, 1902. Cassinia 6:49.

Only five birds (three species) were killed in the spring, but 73 (23 species) died during fall migration at the Philadelphia city hall. Species lists and dates of kill are given.

15. _____. 1906. Abstracts of the Proceedings of the Delaware Valley Ornithological Club for 1906. Cassinia 10:58-64.

Witmer Stone reported that several hundred birds died at the Philadelphia city hall on 28 August. A partial species list is given.

16. _____. 1930. The Cooper River bridge as a factor in the destruction of migrating birds. Bird-Lore 32(1):92-95.

Lights are apparently the cause of bird mortality at this Charleston, S.C. bridge.

17. _____. 1953. Highlights of the early fall migration Aug.-Sept. Kingbird 3(3):67-68.

On 21 September, large numbers of warblers, especially Bay-breasted, were killed at the Empire State Building.

18. _____. 1955. Ceilometer fatalities solved? Feathers 17(12):77.

Ultraviolet filters are being installed on airport ceilometers to help reduce losses to nocturnally migrating birds. The filters, which permit no visible light to pass through, have been used with good results on ceilometers in Nashville and Knoxville, Tenn. (Velie 1963).

19. _____. 1957. Migrating birds killed in flight on TV antenna. Baton Rouge Morning Advocate, 25 September 1957:1,6A.

An estimated 1000 birds were killed at the WBRZ-TV tower during an overcast night.

20. _____. 1961. Large bird kills at TV towers. Bluebird 28(1):9.

A brief summary of two kills in Missouri is given: 658 birds (41 species) and one red bat at Columbia, on 24 September 1960, and about 100 birds (at least 16 species) at Cape Girardeaux on 27 September 1960.

21. _____. 1962a. Report on birds being killed at Quebec Hydro's microwave tower at Hauterville, P.Q.-September 1962. Prov. of Quebec Dep. Game Fish. Unpubl. rep.

Birds are killed regularly at three short towers (460, 300, and 300 feet). No details are given, but a kill of "well over 300" birds is mentioned.

22. _____. 1962b. 28 die in U.S. fog. The Globe and Mail, 2 February:1. Toronto.

Birds caused minor electrical failures in the Sacramento, Calif. area in early February 1962. In thick fog, they crashed into power lines and transmitting towers.

23. _____. 1966a. Towers deadly for birds. Detroit Free Press, 27 April:12C.

A general discussion of the problem is presented with comments from R. R. Graber and C. A. Kemper on the attraction of birds to tower lights.

24. _____. 1966b. News of the birds, summer and early fall, 1966. Nova Scotia Bird Soc. 8(3):15-23.

Included is a report of 115 Blackpoll Warblers found dead at the Cape Sable lighthouse following the clear, cold, windy night of 17-18 October.

25. _____. 1972a. Omega tower bird kill set at 941. Flickertales (N. Dak. Wildl. Fed.) 9(12):6.

During fall 1971, an estimated 941 birds were killed at the 1200-foot Omega tower, LaMoure, N.Dak. A total of 152 birds (41 species), mostly warblers and vireos, was actually collected (Avery et al. 1975).

26. _____. 1972b. An examination of the bird impact problem at the Nanticoke plant of the Ontario Hydro Electric System, Phase II. LGL Limited. Unpubl. rep. 32 pp.

This report, covering fall 1972, includes descriptions of nocturnal bird behavior at the two 656-foot stacks, kill data, and a date-by-date list of bird losses at each stack, with the lighting mode, weather, and moon phase. For the season, 1550 birds of 56 species were found dead; 70% of the losses were at stack 1 which was lit with floodlights. Fewer losses were recorded at this stack when red filters were used than when the floodlights were unfiltered. Stack 2, illuminated by a single white light atop the stack, accounted for only 30% of the kill. Large kills usually occurred on nights with little or no moonlight. In 1970, 2773 birds were killed when no filters were used compared to 754 in 1971 when red filters were in use. Early in the season, most losses occurred after midnight, but starting with 5 October, most losses were recorded early in the night. (See Johansen 1975 for subsequent results at this and other Ontario power stations.)

27. _____. 1975. Youngstown member studies TV tower kill. Bull. Audubon Soc. West. Pa. 40(3):4.

In fall 1974, 268 birds (36 species) were killed at a 1085-foot tower at Youngstown, Ohio. Searches were made daily starting shortly after sunrise. The largest kill occurred during nights of unsettled weather, but some large kills occurred on clear nights as well. There was little evidence of predation. In spring 1975, 48 birds were found dead or injured, and in the fall more than 1050 birds were found dead, including over 300 Ovenbirds (Bartolo 1976).

28. _____. 1976a. Waterfowl power line collisions. Ill. Nat. Hist. Surv. Rep. No. 160:3-4.

This is a less detailed account of Anderson's (1978) study.

29. _____. 1976b. Scare tactics. Natl. Wildl. 14(2):38.

At the State University of New York at Oswego, hundreds of migrating birds have been killed at a double-decked, glass-enclosed bridge. Cutouts of Cooper's Hawks placed in the windows reduced bird losses by 75% to just over 100/year.

30. _____. 1977. A waterfowl study of selected sites within the Klamath Basin and Warner Valley, Oregon. Beak Consultants, Inc., Portland, Oreg. 40 pp.

The impact of a proposed 500 kV power line through the Warner Valley on area waterfowl was evaluated. More waterfowl were observed crossing the proposed route than crossing an existing 69 kV power line. The majority of the former were at elevations of 150-500 feet, whereas most birds crossed the 69 kV line at heights exceeding 500 feet. Twenty-nine dead birds that were collected under the 69 kV line probably struck the wires. Red-winged Blackbirds and American Coots were the primary victims. The removal rate due to scavengers was zero during the four days it was tested.

31. Arbib, R. S., Jr. 1950. Migrating bird mortality at Mitchell Air Force Base, Long Island. Linnaean Newsl. 4(6):2-3.

Following the overcast night of 20 September, 15 birds (6 species) were collected at this airport ceilometer. Death apparently resulted from impact with the ground. A similar incident at the McGuire Air Force Base is mentioned briefly.

32. Arend, P.H. 1970. 1970. The ecological impacts of transmission lines on the wildlife of San Francisco Bay. Wildlife Associates. Report prepared for Pacific Gas and Electric Co. 33 pp.

A study was conducted during June - August 1970 to determine the ecological impacts of transmission lines in the vicinity of San Francisco Bay. Sources of information included a literature review, interviews with local biologists and refuge managers, and personal observations of the author. The literature review revealed no local reports of major avian mortality from collisions with elevated structures. Interviews with area biologists indicated that avian mortality caused by collisions with steel tower transmission lines (60 kV and greater) was rare. Several locations did report losses at wooden pole 12 kV distribution lines. For instance, since 1964, at the Gray Lodge State Waterfowl Management Area near Gridley, Calif., three Golden Eagles, three Great Blue Herons and "numerous" grebes, ducks, and coots were killed through collision or electrocution at a distribution line. From this survey, it is concluded that: "Electric power transmission lines mounted on steel towers cause very minor avian loss and their adverse ecological impact on avian populations is negligible." (See Gill 1974 for a report of considerable shorebird mortality at power lines in this area.)

33. Arnold, J. R. 1960. Black Rail in San Joaquin Valley of California. Condor 62(5):405.

The bird was found dead on 26 August 1959 near Stockton, and had apparently struck a fence or an overhead wire.

34. Arnold, W. W. 1918. A bird hospital. Bird-Lore 20(3):259-262.

A Red-shafted (Common) Flicker broke its wing by flying into a telephone wire.

35. Aronoff, A. 1949. The September migration tragedy. Linnaean Newsl. 3(1):[1-2].

Losses at the Empire State Building (over 200 birds, 30 species) on 10-11 September 1948 are discussed, and a species list is provided. Also discussed are kills at a Nashville, Tenn. airport ceilometer involving 248 birds of 35 species (Spofford 1949a, b); a Philadelphia, Pa. building (at least 11 species); and a 450-foot tower in Baltimore, Md. A list of casualties from the Nashville incident is included.

36. Arthur, R. W. 1961. Birds killed at Bardsey light-1960. Bardsey Observatory Rep. 8:35-37.

In 1960, 395 dead birds were collected at this Welsh light known for its numerous bird kills. (Citation and abstract from Wildl. Rev., December 1963.)

37. Avery, M., and T. Clement. 1972. Bird mortality at four towers in eastern North Dakota-fall 1972. Prairie Nat. 4(3 & 4):87-95.

Throughout the season, 561 birds (88 species) and 5 red bats were collected at four towers, two of which exceed 2000 feet and are reportedly the tallest in the world. The species most frequently killed at the Omega tower, farther south and west than the other three towers, were characteristic of marsh and prairie grassland areas (e.g. Yellow Warbler, American Coot, Sora, Savannah Sparrow), whereas those from the other three towers were characteristic of forest and forest edge habitats (e.g. Dark-eyed Junco, Tree Sparrow, Ovenbird). Species lists of the casualties are given and scavenger activity at the sites is discussed.

38. Avery, M. L., and P. F. Springer. 1973. Investigation of bird migration and mortality at the Omega Navigation Station, LaMoure, North Dakota, fall 1972 and spring 1973. Proc. Bird Control Semin. Bowling Green State Univ. 6:169-170.

Mortality was estimated to be 1037 (66 species, mostly warblers) in fall 1972 and 1417 (51 species, mostly fringillids) in spring 1973. On overcast nights, more birds were observed near the tower (equipped with conventional red warning lights) than 1000 feet to the northeast, while on clear nights the opposite was true. A commercial sound device (Av Alarm, Model TAV-60) was tested as a possible bird deterrent and dispersed birds within 100 feet of the speaker.

39. Avery, M. L., P. F. Springer, and J. F. Cassel. 1975. Progress report on bird losses at the Omega tower, southeastern North Dakota. N. Dak. Acad. Sci. 27(2):40-49.

This paper summarizes the findings of a study of bird mortality at the 1200-foot Omega tower during its first three seasons of operation. Using a stratified sampling plan to estimate total losses, it was found that mortality was about 1000 birds/season for fall 1971 and spring and fall 1972. Actual numbers of dead birds collected for the three seasons were 152 (41 species), 255 (58 species) and 226 (66 species), respectively. Parulids dominated the fall kills while fringillids were more abundant in the spring losses. On overcast nights, significantly more birds were seen near the tower than 305 m to the northeast, but on clear nights, the opposite was true. By checking for casualties daily, shortly after sunrise, removal of dead birds by predators and scavengers was kept to a minimum. Complete species lists for the three seasons' losses are given.

40. _____. 1976. The effects of a tall tower on nocturnal bird migration-a portable ceilometer study. Auk 93(2):281-291.

Using a portable ceilometer (searchlight), nocturnal bird behavior was studied at the 366 m Omega tower in southeastern North Dakota. During the fall 1972 and spring and fall 1973 migration seasons, significantly more birds were observed at the tower on overcast nights than 305 m to the northeast. On clear nights, the opposite was true, suggesting that migrants avoided the tower under clear skies. The behavior of birds milling about the tower on overcast nights is described. The signal emitted by the tower seemed to have no effect on the birds. It is concluded that on overcast nights migrants were not actually attracted to the lighted tower. Rather, moisture droplets in the air caused the light from the red warning beacons to be refracted, thereby increasing the illuminated space around the tower. Migrants passing by were arrested within the lighted area and for some reason were reluctant to leave. Mortality occurred as the migrants milled about and collided with guy wires or the tower itself.

41. _____. 1977. Weather influences on nocturnal bird mortality at a North Dakota tower. Wilson Bull. 89(2):291-299.

Mortality at the 366 m Omega tower in 1972 and 1973 was examined relative to nightly cloud and wind conditions. Most fall losses occurred under overcast skies associated with the passages of cold fronts, as migrants milled about the tower. However, 58% of the spring losses took place on non-overcast nights, mainly through collisions with outlying guy wires. There exists some evidence that behavioral differences among taxa may be involved in migrant mortality at towers. In the spring, rails and fringillids were killed mostly on non-overcast nights, while warblers died in greater numbers on overcast nights. Warblers tended to be killed much closer to the central, lighted structure than were fringillids. Non-passerines suffered substantially greater losses far from the tower than did passerines, especially on non-overcast nights. Behavioral differences have been noted by other investigators (Overing 1936, 1937; Stoddard and Norris 1967; Newman and Andrle 1961).

42. _____. 1978. The composition and seasonal variation of bird losses at a tall tower in southeastern North Dakota. Am. Birds 32(6):1114-1121.

Beginning in September 1971, bird losses were monitored at the 366 m Omega tower for five migration seasons. Overall, 937 birds (102 species) were found dead or injured at the site. Based on a stratified, random sampling system, the average estimated seasonal mortality in 1972 and 1973 was 1075 birds. The composition of the losses varied seasonally- warblers and vireos dominated the fall kills and wrens, icterids and fringillids the spring kills. Species displaying greater spring than fall losses were mainly those that breed abundantly in southeastern North Dakota. A rank correlation analysis showed that the abundance in the field of vireos and warblers and of fringillids was positively correlated with their occurrence in the tower kill in both spring and fall.

43. Avery, M. L., and J. S. Weske. 1978. The racial composition and differential migration of tower-killed Savannah Sparrows in southeastern North Dakota. Bird-Banding 49(2): 182-184.

Of 39 Savannah Sparrows (Passerculus sandwichensis) killed at the Omega tower during 1971-73, 26 possessed characteristics of both the P. s. nevadensis and P. s. oblitus races, suggesting that the majority of migrant Savannah Sparrows passing through the area breed in the region where the ranges of nevadensis and oblitus meet. The possibility of differential migration by race and sex is discussed.

44. Axtell, H. H. 1970. The month. Prothonotary 36(10):122-128.

September migration records obtained from tower kills in the Buffalo, N.Y. area are noted.

45. Bagg, A. M. 1957. The changing seasons. Audubon Field Notes 11(4):312-325.

Spring tower kills at Jacksonville (300 birds) and Leon County (46 birds, 14 species), Fla. are mentioned.

46. _____. 1958. (untitled). Rec. New England Birds 14(9):1.

Three kills are mentioned: (1) 200 birds (17 species) on 16-17 September at the Portland, Me. ceilometer (Packard 1958); (2) 300 birds (22 species) at two Boston, Mass. TV towers on 19-20 September; and (3) 300 casualties at a powerful searchlight in West Springfield, Mass.

47. _____. 1965. The changing seasons. Audubon Field Notes 19(4):438-446.

On the night of 26-27 April, in thick fog, 150-175 birds landed on the deck of a tanker off the New Jersey coast. The only casualties mentioned were 23 Cape May Warblers that apparently struck the ship's superstructure.

48. _____. 1969. The changing seasons. Audubon Field Notes 23(1):4-12.

During September and October 1968, kills were reported from towers in Manitoba, Wisconsin, New York, Ohio, Tennessee (1800 Ovenbirds among the casualties at Nashville) and Florida (853 birds of 80 species at WCTV near Tallahassee).

49. _____. 1970. The changing seasons. Audubon Field Notes 24(1):4-13.

On the night of 22-23 October 1969, 380 birds were killed at a Boston, Mass. skyscraper

50. _____. 1971. The changing seasons. Am. Birds 25(1):16-23.

Overall, at least 20 incidents involving collision mortality at buildings or towers were reported during the four night period 27 Sept. - 1 Oct. 1970 throughout the eastern U.S. These accidents, which claimed at least 9800 birds of 82 species, resulted from the passage of massive cold front. A detailed discussion of the weather and migration during this period is given, and lists of casualties from eight towers and the Empire State Building are included.

51. Bagg, A. M., and R. P. Emery. 1960a. Fall migration: northeastern maritime region. Audubon Field Notes 14(1):10-17.

Included are fall 1959 reports of "few casualties" at Boston, Mass. TV towers as well as 77 dead birds (16 species) at the Dow Air Force Base ceilometer, Bangor, Me. (Ferren 1959) and about 20 birds killed aboard a lightship in Nantucket Sound.

52. _____. 1960b. Spring migration: northeastern maritime region. Audubon Field Notes 14(4): 365-370.

This article contains an account of several species of warblers giving full songs while circling in the ceilometer beam at the Dow Air Force Base, Bangor, Me. (Taverner 1969). In addition, call notes of Green Herons, Spotted Sandpipers, Greater Yellowlegs and Black-bellied Plovers were heard. One Ovenbird was the only casualty.

53. _____. 1964a. Fall migration: northeastern maritime region. Audubon Field Notes 18(1):7-17.

The casualties (over 488 birds, mostly warblers) and weather at a lighthouse in the Bay of Fundy during fall 1963 are discussed at length.

54. _____ 1964b. Spring migration: northeastern maritime region. Audubon Field Notes 18(4): 425-436.

Observations of migrants and casualties at the Gannet Rock, New Brunswick lighthouse in May are presented.

55. Baglien, J. W. 1975. Biology and habitat requirements of the nesting Golden Eagle in southwestern Montana. M.S. Thesis. Montana State Univ., Bozeman. 53 pp.

During the study (1972-74), one Golden and one Bald Eagle were killed at power lines.

56. Bailey, A. M. 1929. Bird casualties. Wilson Bull. 41(2):106-107.

Two female Woodcocks died from collisions, one against a building and the other with an overhead wire. A Black-footed Albatross on Laysan Island struck a wire and broke its wing.

57. Baily, W. L. 1899. Migration data on city hall tower. Cassinia 3:15-19.

From 27 August 1897 through 31 October 1899, 529 birds (56 species) were collected at the 500-foot city hall tower, Philadelphia, Pa. A list of casualties is given.

58. _____. 1901. Birds that struck the city hall tower during the migrations of 1901. Cassinia 5:44.

A list of 17 spring and 38 fall casualties (18 species total) is given.

59. Baird, J. 1962. The changing seasons. Audubon Field Notes 16(1):4-6.

Over 10,000 collisional casualties were reported from around the country during fall 1961. An Eau Claire, Wis. tower accounted for 5097 of these (an estimated 10-20% of the total losses there) whereas two Boston, Mass. TV towers yielded very little despite frequent checks for dead birds. Reports of negative findings are urged.

60. _____. 1964. The changing seasons. Audubon Field Notes 18(1):4-6.

In the U.S. and Canada during fall 1963, 33,406 birds were reported killed at towers and 488 at lighthouses. Most losses resulted from a single cold front that passed through Minnesota and southern Ontario during 18-21 September.

61. _____. 1970. Mortality of fall migrants at the Boylston television tower in 1970. Chickadee 40:17-21.

At this newly constructed 1349-foot tower in Massachusetts, 350 birds (29 species) were collected, 76% of which were warblers. Adults were twice as numerous as juveniles.

62. _____. 1971. Mortality of birds at the Boylston television tower in September of 1971. Chickadee 41:20-24.

Mortality at this Massachusetts tower was less this fall (158 birds, 29 species) than last; 81% of the casualties were warblers, including 95 Blackpolls.

63. Baird, J., and R. Emery. 1959. Fall migration: northeastern maritime region. Audubon Field Notes 13(1):11-13.

In Massachusetts, on the night of 19-20 September 1958, over 300 birds (mostly warblers and vireos) were killed at two Boston TV towers and over 200 (mostly warblers and flycatchers) died at a Springfield searchlight.

64. Baldwin, D.H. 1962. Inquiry into the mass mortality of nocturnal migrants in Ontario - progress report 1. Bull. Fed. Ont. Nat. No. 97:23-27.

Reports of 53 instances of mortality at towers, lighthouses and buildings were obtained by mailing questionnaires (Baldwin and Woodford 1961). Total losses in fall 1961 exceeded 1115 (57 species), most of them from the CKVR-TV tower in Barrie. Ovenbirds (156), Chestnut-sided Warblers (100), Red-eyed Vireos (92), and Bay-breasted Warblers (92) were the most numerous species.

65. _____. 1963. Enquiry into the mass mortality of nocturnal migrants in Ontario - progress report II. Ont. Nat. 1(2):7-15.

Seven locations reported a total of 48 instances of collisional mortality resulting in excess of 3446 casualties (66 species) during fall 1962. Warblers, thrushes, and vireos dominated the kills. Long Point lighthouse was the most destructive structure. A discussion of the attraction of birds to tall, lighted objects is included.

66. _____. 1965. Enquiry into the mass mortality of nocturnal migrants in Ontario. Final report. Ont. Nat. 3(1):3-11.

The 1963 results are presented and compared with those from 1961 and 1962. As in previous years, the bulk of the 1963 casualties (over 1190 birds of 71 species) were warblers, thrushes, and vireos. The 3-year total was in excess of 5789 birds (89 species), and species lists are provided. An account is included describing how mortality was reduced at a British lighthouse by replacing the old white, revolving beacon with an "ice-white" (bluish), flashing one. Floodlighting lighthouses also reduced losses in England, but the same practice increased the mortality at the Long Point lighthouse in Ontario.

67. _____. 1967. Review: Bird casualties at a Leon County, Florida TV tower: an eleven-year study. Ont. Bird Banding 3(4):130-133.

The 1967 report of Stoddard and Norris is reviewed.

68. Baldwin, D. H., and J. Woodford. 1961. An enquiry into the mass mortality of nocturnal migrants in southern Ontario. Bull. Fed. Ont. Nat. No. 92:18-19.

The initiation of a campaign to record and publish information on bird losses at towers, lighthouses, etc. in this region is described. Questionnaires are to be circulated to obtain the desired data.

69. Ball, R. E. 1973-74. Bird mortality at towers in Maryville, Missouri - fall 1972. Trans. Mo. Acad. Sci. 7-8:294.

Three small towers (250, 400, and 408 feet tall, respectively) were checked for dead birds from 5 September to 16 November. No large single-night kills were recorded, and altogether 71 birds of 33 species, mostly sparrows, were recovered. Most casualties are believed to have collided with guy wires rather than the towers themselves. (Abstr.)

70. Bamberg, J., B. R. Warriner, H. O. Todd, and H. C. Monk. 1935. Nocturnal migration in stormy weather. Migrant 6(4):77-80.

Birds heard and seen at an illuminated 100-foot water tower while migrating through Tennessee in poor weather are discussed. About 50 birds (10 species) were found dead in this late October incident.

71. Banko, W.E. 1960. The Trumpeter Swan - its history, habitats, and population in the United States. N. Am. Fauna No. 63. 214 pp.

In the wild, known accidents to Trumpeter Swans seem confined largely to striking fences or overhead wires. Three instances have been reported from Island Park, Idaho where winter fogs cause problems. Single accidents have occurred at the Red Rock Lakes Refuge, Montana and in southeastern Montana. Four of the five accidents were fatal.

72. Banks, R. C. 1979. Human related mortality of birds in the United States. U.S. Fish Wildl. Serv. Spec. Sci. Rep. - Wildl. 215. 16 pp.

Approximately 10 billion birds die annually from all causes. Human activity is responsible for an estimated 196 million deaths annually, 61.5% of which are from hunting. Collisions account for about 31.6% of the annual losses, most (over 57 million) due to road kills. Deaths from window strikes and from collisions with towers and other tall structures are estimated at 3.5 and 1.25 million, respectively.

73. _____. 1976. Reflective plate glass - a hazard to migrating birds. BioScience 26(6):414.

It is estimated that as many as 1.25 million birds are killed at tall buildings, towers, and lighthouses annually, and that 3.5 million may die from striking windows each year. Intermediate to these situations is the ever increasing use of large pieces of reflective plate glass in the construction of new buildings. Mention is made of mortality incidents in St. Louis, Mo. (including five Bobwhite killed on 29-30 November 1973) and Washington, D.C. where no dead birds were found on sidewalks at buildings other than those with reflective plate glass.

74. Barbour, R. W. 1961. An unusual bird mortality at Lexington. Ky. Warbler 37(3):55.

Following the stormy night of 7 May, 82 birds (21 species) were collected at a 670-foot tower.

75. Barrington, R. M. 1900. The migration of birds as observed at Irish lighthouses and lightships. R. H. Porter, London and Edward Ponsonby, Dublin. 952 pp.

This contains a detailed account of birds that were involved in collisions or that were caught or shot at 58 light stations during 1881-97. Observations of 30,000 individual birds were made, and over 2000 specimens were submitted for analysis. The data are summarized by species for the period 1881-87 and for individual years thereafter. Some conclusions derived during the first period of study are: longer-winged birds arrive earlier in the spring than do shorter-winged species, less kill occurs on moonlit as opposed to moonless nights, more birds are killed in the fall than in the spring, fixed lights are more hazardous than revolving or intermittent ones, white lights are believed to be more destructive than red, the direction of migration was usually landward (although this may be biased by the fact that many lights are partly obscured on the landward side), and the force of wind rather than the direction influences the time of departure of migrants. No bats were killed by striking lights.

76. Bartlett, G. A. 1952. A wholesale attraction, but not destruction, of migrating birds by the Albany (N.Y.) airport ceilometer. Feathers 14(11):61-66.

On two nights of overcast and haze, hundreds of birds were observed fluttering in the beam of the ceilometer, but no casualties were found. The birds dispersed when the beam was turned off as evidenced by counts of call notes.

77. _____. 1956. Albany's ceilometer - killer of migrants. Feathers 18(11):57-60.

On the night of 15-16 September 1956, 313 birds of at least 25 species were found dead or injured at the Albany, N.Y. airport ceilometer. The night was drizzly with a low ceiling. When the author arrived at the airport at 0230, most of the damage had been done. Up to 500 birds were seen in the ceilometer beam at once, and there was constant calling. A red fox scavenged on bird casualties for about an hour. By 0630, the air was clear of birds. Eighteen species of warblers accounted for 86% of the losses, with Bay-breasted (41%) and Magnolia (14%) the most numerous. A list of the casualties is given.

78. Bartolo, B. 1976. Bird kill at TV tower. Redstart 43(3):109.

During 18-27 September 1975, 1057 dead birds (39 species) were collected at the WFMJ tower in Youngstown, Ohio. Warblers dominated the kill, with Ovenbirds alone accounting for 30% of the losses. There was some evidence of predator and scavenger activity, particularly by crows. Weather conditions included variable wind, rain and low clouds, and the kill period coincided with the passage of hurricane Eloise. A major kill at Buffalo, N.Y. is mentioned but no details are given (Clark 1975).

79. Bassett, A. S. 1924. A seasonal lighthouse record. Bird-Lore 26(6):427.

A brief account of the mortality (176 birds, 23 species) at a Georgia lighthouse on the nights of 23 and 24 September is presented. Ovenbirds were the principal victims and one Bachman's Warbler was among the casualties.

80. Bauer, E. W. 1960. Vogeltod and Glaswanden. Aus der Heimat 68:58-60.

Bird losses at glass walls and preventive measures are discussed.

81. Baumann, G. 1973. The bird kill at three North Dakota TV-towers in spring of 1973. Zool. Dep., North Dakota State Univ., Fargo. Unpubl. rep. 11 pp.

Checks were made an average of two times weekly at three eastern North Dakota towers. A total of 61 birds of 22 species was collected, although many more were lost to scavengers and predators. Included are lists of casualties by tower date, and maps showing the location of each carcass at each of the sites.

82. Baumgartner, F. M. 1955. The fall migration: southern Great Plains. Audubon Field Notes 9(1):36-38.

Fall 1954 migration records obtained from kills at a Topeka, Kans. TV tower are noted.

83. _____. 1956. Fall migration: southern Great Plains region. Audubon Field Notes 10(1):35-37.

In fall 1955, a kill of 15 Mourning Warblers and 1 Connecticut Warbler was reported from a Topeka, Kans. TV tower.

84. _____. 1959. Fall migration: southern Great Plains region. Audubon Field Notes 13(1):43-45.

On 11 October 1958, "a large box of birds" including Long- and Short-billed Marsh Wrens was picked up at a Dallas TV tower.

85. _____. 1961. Fall migration: southern Great Plains region. Audubon Field Notes 15(1):54-56.

On 22 October 1960, 11 Yellow Rails were found beneath a Dallas, Tex. TV tower; three were still alive.

86. _____. 1963. Fall migration: southern Great Plains region. Audubon Field Notes 17(1):45-46.

A kill at an Oklahoma City, Okla. TV tower in September 1962 is noted.

87. Beebe, W. 1935. Rediscovery of the Bermuda Cahow. Bull. N. Y. Zool. Soc. 38(6):187-190.

A young bird of this species of shearwater, first described in 1906 and thought to be extinct, was killed at a lighthouse in Bermuda in 1935.

88. Beer, J. V., and M. A. Ogilvie. 1972. Mortality. Pages 125-142 in Peter Scott and the Wildfowl Trust, the Swans. Houghton Mifflin Co., Boston.

Swans are frequently involved in collisions with overhead wires. Such accidents are the most commonly reported cause of death among Mute Swans in Britain. Of 1050 birds found dead, 65% had suffered collisions, two-thirds of which involved overhead wires. In some areas, overhead wires are a major factor in limiting populations of swans. Wires are especially lethal where they cross rivers or canals or pass near concentrations of birds. In Kent, 30% of a local Mute Swan flock were killed in 2 months along a 1/4 mile stretch of power line. Of the swan killed at overhead wires, it is not known how many die of impact and how many are electrocuted. (See also Harrison 1963 and Ogilvie 1967.)

89. Belcher, M. 1962. First Yellow Rail record for Regina. Blue Jay 20(4):153.

A Yellow Rail found at the Regina, Sask. TV tower on 7 October (Lahrman 1962) is the first record for the city. This species is an infrequent tower kill casualty.

90. Belcher, M., A. Binnie, and B. Binnie. 1966. The 1965 fall warbler migration at Regina. Blue Jay 24(1):10-15.

Previous losses of warblers at Regina, Sask. TV towers are reviewed (Nero 1961, Lahrman 1962), and losses during the 1965 fall season are discussed in detail. The largest kill of the season occurred on the night of 30-31 August when 172 birds were killed at the CHRE tower and 227 were collected at CKCK. Warbler casualties for the season totaled 150 (14 species) at CHRE and 281 (16 species) at CKCK. The most frequently killed species were the Tennessee Warbler (142), Yellow Warbler (51), Northern Waterthrush (46), and Wilson's Warbler (43). The warbler losses are listed by species and date of collection.

91. Bennett, F. M. 1909. A tragedy of migration. Bird-Lore 11(3):110-113.

Bird mortality at lighthouses in the Florida Keys during a violent April thunderstorm is discussed. Possibly tens of thousands of birds died, particularly at Dry Tortugas. A detailed account of bird behavior at the light is included. Summer Tanagers, Indigo Buntings, and Ovenbirds were the most prominent species.

92. Benning, W. E. 1978. Region 3 - Finger Lakes. Kingbird 28(1):42-44.

During the cloudy, rainy period of 20-24 September 1977, a record 3862 birds were found dead at the Elmira, N.Y. TV tower. On the night of 19-20 September alone, 1817 birds of 39 species were collected. Of the 48 total species, 24 were warblers (Howard 1977).

93. Bent, A. C. 1953. Life histories of North American wood warblers. U.S. Nat. Mus. Bull. No. 203:404.

Large scale mortality of nocturnal migrants, especially Blackpoll Warblers, is discussed. At the Fire Island light on Long Island, N.Y., 356 of 595 birds killed on 23 September 1887 were Blackpolls, and 199 of this species died at the Long Point, Ont. lighthouse during 24-29 September 1929. Kills at the Washington Monument are mentioned.

94. Benton, A. H. 1954. Relationships of birds to power and communication lines. Kingbird 4(3):65-66.

While acknowledging some losses of birds due to striking overhead wires, the author states that "power and communication lines now represent a valuable asset to bird life" in the form of nest and perch sites.

95. Benton, A. H., and L. E. Dickinson. 1966. Wires, poles, and birds. Pages 390-395 in A. Stefferud, ed. Birds in our lives. U.S. Dep. Inter., Washington, D.C.

The authors discuss damage done by birds to utility poles and wires (Dickinson 1957) and the ways in which birds benefit by their presence (Benton 1954). Reference is made to the electrocution of eagles and other species.

96. Bernard, R. F. 1966. Fall migration: western Great Lakes region. Audubon Field Notes 20(1):45-46, 50-53.

On 6 September 1965, 7085 dead birds (55 species) were collected at an Eau Claire, Wis. tower. At least 500 birds died by striking lighted windows and a neon sign near Newberry, Mich. on 26 September.

97. Bierly, M. L. 1973. 1971 fall television tower casualties in Nashville. Migrant 44(1):5-6.

In what was described as an "average season", 990 birds (52 species) died at the WSM tower and 135 (24 species) at WSIX.

98. Bijleveld, M. F. I. J., and P. Goeldlin. 1976. Electrocution d'un couple de Buses Buteo buteo a Jongny (VD). Nos. Oiseaux 33(6):280-281.

A pair of hawks was electrocuted at a 17 kV power line in Switzerland.

99. Black, C. A. 1922. Some bird notes from central and western Nebraska. Wilson Bull. 34(1):43.

Two Broad-tailed Hummingbirds struck a store window and died.

100. Blain, A. W. 1948. On the accidental death of wild birds. Jack-Pine Warbler 26(2):58-60.

Several reports from Michigan of birds being killed by striking windows are related. Species involved included a Red-shouldered Hawk, Bobwhite, and Ring-necked Pheasant.

101. Blokpoel, H., and D. R. M. Hatch. 1976. Snow Geese, disturbed by aircraft, crash into power lines. Can. Field-Nat. 90(2):195.

On 8 May 1974, several thousand Snow and Blue Geese were feeding in a stubble field in Manitoba when a low-flying aircraft caused them to take wing. In the "chaotic" rush into the air, 25-75 birds were killed or injured by striking power lines that bordered one side of the field. It is not known whether death resulted from impact or from electrocution.

102. Boeker, E. L. 1972. Powerlines and bird electrocutions. U.S. Dep. Inter., Denver Wildl. Res. Cent. Unpubl. rep. 8 pp.

This report gives a brief overview of the problem of birds, especially eagles, being electrocuted at power lines. Several instances of eagle electrocutions are mentioned and recommendations for mitigating the hazard are presented.

103. Boeker, E. L., and P. R. Nickerson. 1975. Raptor electrocutions. Wildl. Soc. Bull. 3(2):79-81.

During 1969-71, over 300 eagles died by electrocution in the western U.S. Documented losses of raptors in 1972 and 1973 throughout the country totalled 281, 250 of which were Golden Eagles. Many victims were young birds and nearly all deaths occurred on the small distribution lines on which the conductors are only three to four feet apart. Particularly troublesome stretches of line were modified to alleviate the hazard.

104. Bonhote, J. L. 1901. On a collection of birds made by Mr. T. R. Thompson at the Cay Lobos Lighthouse, Bahamas. Auk 18(2):145-149.

Warblers were the most frequently killed group at the lighthouse. A kill list is given.

105. _____. 1903. Bird migration at some of the Bahama lighthouses. Auk 20(2):169-179.

Included are lists of casualties, mostly warblers, from three lighthouses and observations by a lightkeeper of bird behavior during a kill. According to the lightkeeper, "the birds invariably come up to the light against the wind and strike on the lee side of the lantern."

106. Booth, H. B. 1940. Notes on the nesting of a pair of Mute Swans. Naturalist (London) 1940:204-206.

A cygnet struck telegraph wires.

107. Borell, A. E. 1939. Telephone wir[illegible] fatal to Sage Grouse. Condor 41(1):85-86.

In Utah, three birds were found dead under roadside telephone wires.

108. Boso, B. 1965. Bird casualties at a southeastern Kansas TV tower. Trans. Kans. Acad. Sci. 68(1):131-136.

The 1200-foot KOAM-TV tower was checked regularly in the fall of 1963 (75 birds, 35 species) and spring 1964 (50 birds, 14 species). A species list, weather on days of collection, and the distribution of casualties about the tower are given.

109. Bourne, W. R. P. 1976. Petrels and lights at night. Notornis 23(2):201-202.

The author feels that the simplest explanation for the attraction of birds to lights is that birds which become lost in a mist make for the nearest light hoping to find their way out (Imber 1975).

110. Boyd, H. 1961. Reported casualties to ringed ducks in the spring and summer. Wildfowl Trust Ann. Rep. 12:144-146.

Among ducks banded in Britain, Mallards are more frequently involved in wire strikes than are Teal. Male ducks seem more likely to be killed by wires than females.

111. Boyd, H., and M. Ogilvie. 1964. Losses of Mute Swans in England in the winter of 1962-63. Wildfowl Trust Ann. Rep. 15:37-39.

Losses due to collisions with overhead wires were abnormally low in January and February 1963, accounting for only 35 of the 264 reported deaths.

112. Boylan, B. T., Jr. 1956. Lake Andes birdlife 40 years ago. S. Dak. Bird Notes 8(3):40-41, 43.

A Whooping Crane was injured, probably by flying into a telephone wire.

113. Bradley, M. 1975. A study and analysis of man-made navigational hazards to birds in the vicinity of Richmond, Indiana. Earlham College, Richmond, Ind. Unpubl. rep. 14 pp.

During spring migration, mortaltiy was monitored at two small towers and at windows of buildings on the Earlham College campus. Two tower casualties were found, and 51 were collected at windows, where reflection and transparency contributed to the collisions. Larger species were usually stunned after striking windows, while smaller birds were killed outright.

114. Bradstreet, M. S. W., and P. S. Woodford. (undated). Nocturnal migration. Pages 19-23 in Long Point Bird Observatory Ten Year Report '60-'69.

During the 10 years, about 6800 birds (101 species) were collected at the Long Point, Ont. lighthouse. A complete list of species killed for each year is given. Ovenbirds (1142) and Swainson's Thrushes (1004) were the most frequently killed species.

115. Brady, A. 1969. An electrocuted Great Horned Owl. Cassinia 51:57.

Presumably, this occurred when the prey item held by the owl touched the wire below which the owl was perched and created a short circuit.

116. Breckenridge, W. J. 1958. Fall migration: western Great Lakes region. Audubon Field Notes 12(1):32-33.

Between 31 August and 20 September 1957, three large kills were reported at a new 1000-foot tower in Eau Claire, Wis. The 2972 casualties (42 species) on 19-20 September included 23 species of warblers (Kemper 1958a).

117. _____. 1959. Spring migration: western Great Lakes region. Audubon Field Notes 13(4): 371-373.

On 17 May, 284 birds were killed at a Detroit TV tower.

118. Bretherton, B. J. 1902. The destruction of birds by lighthouses. Osprey 1(5):76-78.

A general discussion of the problem of birds being killed at lighthouses is presented. It is theorized that the lantern atop a lighthouse looks like a star to migrants, and on foggy nights they fly toward it because it is the only fixed point visible. Many of the birds crash into the light, but others flutter around it until they die of exhaustion. Other observations: "No birds are more persistent in their efforts at self destruction than the little Petrels. . .", new lighthouses are more destructive than ones that have existed for several years, and lighthouses with foghorns have only slight losses.

119. Brewer, R., and J. A. Ellis. 1958. An analysis of migrating birds killed at a television tower in east-central Illinois, September 1955- May 1957. Auk 75(4):400-414.

This is a comprehensive account of the mortality at the 983-foot WCIA tower near Champaign. Seven instances of mortality are considered in this analysis which includes species lists (486 dead birds, 51 species), weather data, comparisons with kills elsewhere, sex, age and fat content of birds collected, spatial distribution of the casualties at the tower site, and a discussion of the attraction of migrants to the tower.

120. Brewster, W. 1886. Bird migration. Mem. Nuttall Ornithol. Club 1:1-22.

Included are observations of bird losses at the Pt. Lepreaux lighthouse in the Bay of Fundy, August and September 1885. Nightly accounts of losses and bird behavior at the light are given. The author concludes: (1) birds come to the light only on densely cloudy or foggy nights, (2) the greatest numbers come on nights when the first hour or two are clear, and (3) heavy flights are almost always preceded by clear, cool days.

121. Brooke, M. de L. 1970. Some aspects of Mute Swan movement and mortality. Cambridge Bird Club 44:44-47.

From 1960 to 1970, 56 banded swan were found dead. Of the nine for which cause of death was known, five died from collisions with wires.

122. Brooks, M. 1951. Fall migration: Appalachian region. Audubon Field Notes 5(1):14-16.

At least 165 birds (23 species) were killed during the night of 17 September 1950 in dense fog at Bluff's Lodge on the crest of the Blue Ridge near Roanoke, Va. A partial species list is given.

123. _____. 1952. Fall migration: Appalachian region. Audubon Field Notes 6(1):16-17.

At the Knoxville, Tenn. airport ceilometer, 1044 birds (46 species) were collected on the morning of 8 October 1951. A partial list of the species killed is given (Howell and Tanner 1951).

124. _____. 1955. Fall migration: Appalachian region. Audubon Field Notes 9(1):24-26.

A total of 267 casualties, including 81 Ovenbirds, was reported from the Knoxville, Tenn. airport ceilometer in fall 1954.

125. Brown, L., and D. Amadon. 1968. Eagles, hawks and falcons of the world. McGraw-Hill Book Co., N. Y. Vol. 1. 450 pp.

Mortality factors discussed include electrocution, which chiefly affects large species of eagles and hawks.

126. Browne, M. M., and W. Post. 1972. Black rails hit a television tower at Raleigh, North Carolina. Wilson Bull. 84(4):491-492.

The birds were found at the 1175-foot WRAL tower on 19 September 1969 and 27 September 1970. No other mortality is mentioned.

127. Brownstein, R. 1971. The month. Prothonotary 37(10):127-131.

Various September migration records from Buffalo, N.Y. area tower kills are mentioned.

128. Bruijns, M. F. M., and L. J. Stwerka. 1961. Het doodvliegen van vogels tegen ramen. Levende Nat. 64(11):253-258.

Avian mortality at windows of about 500 buildings in Holland was surveyed during 1958-61. Total losses were 2000 birds (74 species), primarily of species breeding near houses, gardens, and parks. It is estimated that 200,000-300,000 Blackbirds, Turdus merula, are killed annually at windows. Preventive measures are discussed. (From translation supplied by Daniel Klem, Jr.)

129. Brunetti, O. A. 1965. Supplementary report, cause of death of the Pinehurst condor. Calif. Dep. Fish Game. Unpubl. rep.

An investigation into the cause of death of a California Condor led to the conclusion that the bird struck some object, possibly a power line, which stunned it so that it fell unimpeded to the road below and was killed.

130. Bub, H. 1955. Observations on the autumn migration in the area between the Sea of Azov and the Caspian. Ibis 97(1):25-37.

Losses of over 200 birds (28 species) due to collisions with telegraph wires in southern Russia are listed. Among the casualties were over 50 Quail and Partridge.

131. Bull, J. 1964. Birds of the New York area. Harper and Row, New York. 540 pp.

Included in this book are reports of mortality at lighthouses (Dutcher 1884 and 1888), the Empire State Building (212 birds of 30 species on 11 September 1948), and the Westhampton Air Force Base (596 birds of 47 species on 5 October 1954).

132. _____. 1974. Birds of New York State. Doubleday/Natural History Press, Garden City, N. Y. 655 pp.

Various references to bird kills in the state are made in several of the species accounts.

133. Bullis, H. R., Jr. 1954. Trans-Gulf migration, spring 1952. Auk 71(3):298-305.

Migrants struck a lighted ship in the Gulf of Mexico. Casualties included a Least Bittern, Sora, and Barn Swallow.

134. Burleigh, T. D. 1934. A critical study of the distribution and abundance of Dendroica castanea and Dendroica striata in the southeastern states during the spring and fall migrations. Wilson Bull. 46(3):142-147.

Twenty-nine Bay-breasted Warblers (Dendroica castanea) were killed at a lighthouse near Pensacola, Fla. on 26-27 October 1925.

135. Burton, D. E., and J. Woodford. 1960. The spring migration: Ontario-western New York region. Audubon Field Notes 14(4):383-386.

On the foggy, rainy night of 19-20 May, "hundreds of birds" were seen flying around the Long Point, Ont. lighthouse. There were 56 casualties, mostly warblers.

136. Bush, M. R. 1967. A study of the non-predatory deaths of certain avian species at the WBAL-TV tower. Unpubl. rep.

In seven incidents during 1964-66, 3595 birds (74 species) were collected at this 1000-foot Baltimore, Md. tower. Ovenbirds (883), Black-and-white Warblers (467) and Magnolia Warblers (393) dominated. All losses except 740 on 28 April 1966 occurred in September and October.

137. Buskirk, W. H. 1967. A preliminary bibliography on mortality of nocturnal migrants. Louisiana State Univ., Baton Rouge. Unpubl. rep. 91 pp.

In addition to 184 references, the author includes a summary of the cause (tower, ceilometer, etc.), location and date of kills; a table listing the species mentioned in each kill; and a tabulation of 83 complete lists of kills from the literature. This is a very useful reference.

138. Cadbury, C. J., R. E. Scott, and L. J. Roberts. 1971. Bird deaths from power lines at Dungeness, Kent. Ibis 113(3):415-416.

This is an abstract of a paper presented at the annual conference of the British Ornithologists' Union in April 1971. Details of the study are given by Scott et al. 1972.

139. Caldwell, L. D., and N. L. Cuthbert. 1963. Bird mortality at television towers near Cadillac, Michigan. Jack-Pine Warbler 41(2):80-89.

From 26 September to 16 October 1961, 812 birds (42 species) were collected at the 1295-foot WWTV tower. An index of similarity revealed the fall mortality to be most like the kills reported from Nashville, Tenn. and Eau Claire, Wis. In spring 1962, 74 birds (27 species) were found at WWTV and 125 (36 species) were collected from a nearby 1130-foot tower. The species composition in the spring was markedly different from the fall.

140. Caldwell, L. D., E. P. Odum, and S. G. Marshall. 1963. Comparison of fat levels in migrating birds killed at a central Michigan and a Florida gulf coast television tower. Wilson Bull. 75(4):428-434.

Mean fat levels in six tropical-wintering species killed in fall migration at WCTV (Tallahassee) were greater than in the same species killed at WWTV (Cadillac). The results support the hypothesis that long-range migrants begin their southward flight with low or moderate fat levels and increase their reserves as they move south, until maximum fat levels are reached at points near the gulf coast prior to the start of long, nonstop over-water flights. Spring fat levels in four species breeding in Michigan were not significantly different between the two locations.

141. Caldwell, L. D., and G. J. Wallace. 1966. Collections of migrating birds at Michigan television towers. Jack-Pine Warbler 44(3):117-123.

The spring and fall species composition of losses during 1959-64 at seven sites are analyzed. Data from the study of Caldwell and Cuthbert (1963) are included. Towers within 30 miles proximity had virtually the same composition whereas greater diversity occurred among more distant towers. Spring and fall species compositions were markedly different, possibly due to different migration routes for various species. Warblers and thrushes were the most common casualties.

142. Carleton, G. 1965. Fall migration: Hudson- St. Lawrence region. Audubon Field Notes 19(1):18-21.

Approximately 500 birds, mostly warblers, died at the Empire State Building early on the morning of 14 September 1964.

143. Carmody, D. 1970. Confused birds die at Empire State. New York Times, 29 September.

Hundreds of birds (no accurate count was possible) were killed at the Empire State Building on the night of 27-28 September despite the fact that floodlights that normally illuminate the building had been turned off. Many stunned or injured birds were collected by Audubon Society members and released later in the day.

144. Carpenter, F., and H. B. Lovell. 1963. Bird casualties near Magnolia, Larue County September 25, 1962. Ky. Warbler 39(2):19-21.

On a foggy night 270 birds (30 species) were killed at lighted windows. Swainson's Thrushes, Bay-breasted Warblers, and Ovenbirds headed the kill list.

145. [Carson, L. B.] 1954a. Destruction of birds at a television tower at Topeka, Kansas. Topeka Audubon News 9(1):1-2.

The 1010-foot WIBW tower killed at least 700 birds (48 species) from 7 September through 1 October.

146. [_____.] 1954b. Further destruction at a television tower at Topeka, Kansas. Topeka Audubon News 9(2):5-7.

The entire fall kill at the WIBW tower exceeded 1000 birds (68 species) including no shorebirds, 10 Mourning Doves and one duck species.

147. _____. 1954c. New records for fall migrants in eastern Kansas. Kans. Ornithol. Soc. Bull. 5(4):27-29.

First, last and peak kill dates are given for 68 species (1023 birds) killed at the WIBW tower in Topeka during September and October. Tordoff and Mengel (1956) analyzed the kill at this tower in detail.

148. [_____.] 1955a. The season--. Topeka Audubon News 10(1).

The first fall casualties at the WIBW tower at Topeka, Kansas were collected on 10 September and comprised nine birds of six species. Two red bats were killed on 22 September, and other casualties, including a Black Tern, are mentioned. Scavenger/predator activity was observed.

149. [_____.] 1955b. The season--. Topeka Audubon News 10(2).

During fall 1955, 321 birds of 43 species died at the WIBW tower. A kill list, with dates of kill is given.

150. [_____.] 1956a. The season--. Topeka Audubon News 11(1).

Through mid-September, the only fall 1956 casualty at the WIBW tower was an Alder Flycatcher.

151. [_____.] 1956b. The season--. Topeka Audubon News 11(2).

The Topeka tower was not a migration hazard in fall 1956 because of mild weather.

152. [_____.] 1967. History repeats itself--. Topeka Audubon News 22(2).

On October 7 after two days of low ceilings and rain, over 800 birds (43 species) were collected at a new, taller Topeka tower. Included in the partial species list are 238 Nashville Warblers. Since 1954, the smaller WIBW tower has not been very lethal to migrants.

153. Carter, J. H., III, and J. F. Parnell. 1976. TV tower kills in eastern North Carolina. Chat 40(1):1-9.

A large kill occurred in October 1970 (1000+ birds, 39 species) at the 1994-foot WECT tower, and in fall 1971 and 1972 regular checks (after the passage of cold fronts and after most cloudy nights) were made at WECT and at the 1188-foot WWAY tower about 30 miles away. Losses in 1971 (2683 birds) were typically associated with the passage of cold fronts when low ceilings and north winds prevailed. In 1972, cold fronts passed quickly through the area and only 387 casualties were found. Many carcasses were no doubt overlooked in the vegetation at the tower sites and there was much evidence of predator/scavenger activity. A combined annotated species list is included.

154. Case, L. D., H. Cruickshank, A. E. Ellis, and W. F. White. 1965. Weather causes heavy bird mortality. Fla. Nat. 38(1):29-30.

In early October 1964, 4707 birds (37 species) were killed by striking brightly lit buildings, towers, cars and other obstacles. Reportedly, "clouds of birds" were circling buildings as early as 2200. Weather consisted of a low ceiling, drizzle and northerly winds. Warblers accounted for 98.7% of the casualties.

155. Chamberlain, B. R. 1954. Diaster in migration. Chat 18(4):104-105.

On 7 October, under overcast skies, a "rain" of migrants occurred at several locations in the southeastern U.S. Presented here are partial species lists from ceilometers and towers at Charleston, S.C. (100 birds, 24 species) and Winston-Salem, N.C. (190 birds, 21 species). Common Yellowthroats dominated the Charleston kill, and 30% of the casualties at Winston-Salem were Ovenbirds.

156. _____. 1955a. Fall migration: southern Atlantic coast region. Audubon Field Notes 9(1):17-18.

Heavy mortality at beacons, towers, ceilometers, and lighted windows was reported from several southeastern cities in October 1954. Red-eyed Vireos and Ovenbirds were the most common species (Chamberlain 1954 and Johnston 1955).

157. _____. 1955b. More ceilometer data. Chat 19(1):26.

An estimated 1.5-2.5 million birds were killed in the east and southeast in early October 1954 as a cold front passed through the regions. Most losses occurred at airport ceilometers. A ceilometer at Greenboro, N.C. that was off about 90% of the time killed only 30 birds during the fall.

158. _____. 1956. Fall migration: southern Atlantic coast region. Audubon Field Notes 10(1):15-18.

Kills of 112 at the Charlotte, N.C. ceilometer and 500+ at Atlanta and Marietta, Ga. in late September 1955 were reported. Red-eyed Vireos, Swainson's Thrushes and warblers were the most common victims.

159. _____. 1957a. Fall migration: southern Atlantic coast region. Audubon Field Notes 11(1):15-18.

About 2500 birds, mostly warblers, were killed at the Chapel Hill, N.C. TV tower on 28-29 September 1956.

160. _____. 1957b. Spring migration: southern Atlantic coast region. Audubon Field Notes 11(4):333-337.

Light casualties were reported from a tower at Chapel Hill, N.C.

161. _____. 1958. Fall migration: southern Atlantic coast region. Audubon Field Notes 12(1): 19-21.

During fall 1957, over 1100 birds (80 species) were killed at an Aiken S.C. tower. Smaller kills were reported from Raleigh and Charlotte, N.C. and Camp Cornelia and Atlanta, Ga.

162. _____. 1959. Roadblock, an experiment. Chat 23(1):32-33.

Pasting two large prints of owl eyes on a picture window helped reduce bird strikes at Matthews, N.C.

163. _____. 1960. Fall migration: southern Atlantic coast region. Audubon Field Notes 14(1): 23-25.

"There were no real cold fronts, and obstruction kills were extremely light" at Atlanta, Ga. and Charlotte, N.C.

164. _____. 1961a. Fall migration: southern Atlantic coast region. Audubon Field Notes 15(1): 23-26.

During 28 September- 2 October 1960, the Charlotte, N.C. tower losses exceeded 340 birds. Smaller kills were reported during 8-17 October.

165. _____. 1961b. Tower casualties at Columbia S.C. Chat 25(1):18-19.

This article consists of a letter from Mrs. E. D. Smith (Smith and Tedards 1962) describing bird losses at the 1600-foot WIS tower. On 29 September 1960, hundreds of carcasses that had been piled up by station personnel were examined, and 12 species were identified. On 2 October, 18 additional species were found (no numbers given). According to station personnel, as many birds hit the tower on clear nights as did in poor weather. Signs of owls, foxes, and wild cats indicated much predator activity on the carcasses. It was estimated that 500 birds died, the major casualties being vireos, thrushes, Common Yellowthroats, Magnolia Warblers, and American Redstarts. (See Norwood 1960 for kills at Charlotte, N.C. on the same dates.)

166. _____. 1962. Fall migration: southern Atlantic coast region. Audubon Field Notes 16(1): 18-21.

A migration record from an Aiken, S.C. tower kill is mentioned.

167. Clark, A. R. 1973. Avian mortality at three western New York television towers. M. A. Thesis. State University College, Buffalo, N.Y. 129 pp.

Nocturnal avian mortality was studied at three television towers in southern Erie County, N.Y. during the autumn migration seasons 1967-71. Altogether, 4094 birds of 82 species were collected. Mortality was analyzed with regard to type of tower, weather conditions, and species composition. Birds were killed by striking both towers and guy wires, but effects of differences among towers were not apparent. Kills were usually associated with the passage of cold fronts (northerly wind, overcast) although two kills exceeding 100 birds occurred under nonfrontal overcast. The difficulties in using migration and tower kill data for comparisons of species composition are discussed. Not all species were killed in proportion to their numbers migrating through area. This was particularly true among waterfowl, shorebirds, and some fringillids. But many species of tower-killed warblers, vireos, and thrushes did provide good samples of the migrant population (Avery et al. 1978, Weise 1971). An annotated species list and daily kill lists are provided. The five most commonly killed species were the Ovenbird (462), Golden-crowned Kinglet (413), Swainson's Thrush (301), Blackpoll Warbler (270), and Red-eyed Vireo (248).

168. _____. 1974a. Tower kill record. Prothonotary 40(9):102-103.

Lists are given of kills on 28 (41 birds, 11 species) and 30 (4 birds, 3 species) August at several towers in the Buffalo, N.Y. area.

169. _____. 1974b. (untitled). Prothonotary 40(10):112-115.

Casualties, mostly warblers, at three Buffalo, N.Y. area towers are listed. The largest kills occurred on 21 September (383 birds, 37 species) and 30 September (268 birds, 28 species).

170. _____. 1975. Television tower bird kill- September 1975. Prothonotary 41(10):131-136.

Lists of kills at three Buffalo area towers during 18-27 September are given. The largest kill occurred on the 24th: 1142 birds of 53 species.

171. _____. 1976. Erie County television tower casualties: 1976. Prothonotary 42(11):144-146.

At three Buffalo area towers, a total of 487 birds (58 species) was found on 18 checks between 26 August and 25 October. Complete lists are given for the total kill, and each of six dates with a kill of at least 25 birds is listed separately as well. In 10 years of monitoring the kill at these towers over 8300 birds have been collected (99 species).

172. _____. 1977. Erie County television tower casualties: 1977. Prothonotary 43(12):198-200.

In fall 1977, 1397 birds (50 species) were collected on 23 visits between 10 August and 11 November to three towers near Buffalo, N.Y. This is the fourth highest seasonal total in the 11 years that kills have been monitored here. Bay-breasted Warblers (174), Ovenbirds (156), and Magnolia Warblers (116) were the most frequently killed species. The four nights from 20-21 to 23-24 September accounted for 95% of the total losses. Overcast and northerly wind prevailed during this period. Large kills were also reported from Elmira, N.Y. (Howard 1977) and the Long Point, Ont. lighthouse where 1411 birds (48 species) were killed during the season. Blackpoll (207), Bay-breasted (158), and Magnolia (133) Warblers, Common Yellowthroats (109), and Swainson's Thrushes (106) were the most common casualties at Long Point. A large kill at a lighthouse on Manitoulin Island, Ont. is mentioned but no details are provided. Complete kill lists from the Buffalo and Elmira towers are given.

173. Clarke, W. E. 1912. Studies in bird migration. Gurney and Jackson, London. 2 vols.

Included are very detailed observations of birds attracted to lighthouses and lightships in the British Isles. (The descriptions of the behavior of migrants at lights contained here and in the Kumlien (1888) article are the most complete and informative that we read.)

174. Cochran, W. W., and R. R. Graber. 1958. Attraction of nocturnal migrants by lights on a television tower. Wilson Bull. 70(4):378-380.

Counts of flight calls on two nights at a 984-foot tower near Champaign, Ill. indicated that migrants were concentrated in the vicinity of the structure. Turning off the red warning lights on the tower eliminated the aggregation. This article is the first to provide any experimental evidence that nocturnal migrants actually congregate around the red warning lights on towers.

175. Coffey, B. B., Jr. 1954. Ceilometer and other indications of nocturnal migration, Memphis, October 1953. Migrant 25(1):11-13.

Birds were observed fluttering in a ceilometer beam, and 10-20 deaths resulted. At times it was impossible to distinguish birds from insects.

176. _____. 1964. Two bird kills at WMC-TV, Memphis. Migrant 35(2):53.

On 7 and 8 May 1961, 19 warblers and vireos (11 species) were collected at the WMC-TV tower in Memphis, Tenn. A second incident involving 99 birds (21 species), including 57 Red-eyed Vireos, occurred on 11 May 1964.

177. Cohen, D. A. 1896. California department. Osprey 1(1):14-15.

On 15 May, 14 Red Phalaropes and one Ruddy Duck were found dead near a telegraph line. Autopsies indicated that the birds had died from collisions with the overhead wire.

178. Cooke, W. W. 1888. Report on bird migration in the Mississippi Valley in the years 1884 and 1885. U.S. Dep. Agric., Div. Econ. Ornithol. Bull. No. 2. 313 pp.

Hundreds of Soras were seen at a lighted tower at Winona, Minn. on the night of 21 May 1884 and suffered the highest losses of all species. Several Red-eyed Vireos were killed at a light at LaCrosse, Wis. on 19 May 1884. Reference is made to published losses of Bachman's and Kirtland's Warblers at lights.

179. _____. 1915. Bird migration. U.S. Dep. Agric. Bull. No. 185. 47 pp.

The Washington Monument killed 150 birds one night in spring 1902, and, while lighted, the Statue of Liberty caused the deaths of up to 700 birds a month. Many birds are killed at lighthouses, particularly in the fall. Two lighthouses at the southern end of Florida have killed far more birds than other lighthouses. Both are 100-140 feet high and have first magnitude lights. A fixed white light is the deadliest, while it is said a flashing light frightens birds away and a red light is avoided.

180. Coon, N. C., L. N. Locke, E. Cromartie, and W. L. Reichel. 1970. Causes of Bald Eagle mortality, 1960-1965. J. Wildl. Dis. 6:72-76.

Of 76 dead eagles examined, 7 died from impact or collision.

181. Cornwell, G. W. 1968. Needless duck deaths. Conserv. Catalyst 2(4):15-18.

About half of 3000 non-hunting deaths were due to striking wires.

182. Cornwell, G., and H. A. Hochbaum. 1971. Collisions with wires- a source of anatid mortality. Wilson Bull. 83(3):305-306.

Barbed wire fences and overhead wires commonly kill ducks, but such incidents are seldom reported.

183. Cottam, C. 1929. A shower of grebes. Condor 31(1):80-81.

Hundreds of Eared Grebes died by striking wires, houses and trees after being forced to fly low in a snowstorm at Caliente, Nev. in December 1928.

184. Coues, E. 1876. The destruction of birds by telegraph wire. Am. Nat. 10(12):734-736.

In a 3-mile stretch between Cheyenne and Denver, Coues counted over 100 dead birds, mostly Horned Larks, lying beneath the telegraph line. Three birds were actually seen striking the wires.

185. Crawford, R. L. 1971. Predation on birds killed at TV tower. Oriole 36(4):33-35.

To test the effects of scavengers at the WCTV tower near Tallahassee, Fla., 157 marked dead birds were placed out over a period of five nights. The nightly loss of test birds to scavengers was between 64% and 100%. The author concludes that serious attention must be paid to the predator/scavenger problem at towers if meaningful data are to be obtained.

186. _____. 1974. Bird casualties at a Leon County, Florida TV tower: October 1966- September 1973. Tall Timbers Res. Sta. Bull. No. 18. 27 pp.

This is a continuation of the study by Stoddard and Norris (1967). During the seven years covered in this report, over 5500 casualties and seven new species were collected at the WCTV tower, bringing the total losses to about 35,000 (177 species) in 18 years of continuous monitoring. Monthly species lists are given for the last seven years, and the total kill is presented by spring and fall months for each year 1955-73. Much of this report is devoted to the problem of scavengers removing tower casualties (Crawford 1971). An extensive literature review is included in the introduction.

187. _____. 1976a. Willow and Alder Flycatcher records at a north Florida TV tower. Fla. Field Nat. 4(1):1-4.

Of 19 "Traill's Flycatchers", 9 were Empidonax traillii and 10 were E. alnorum. (From supplement to Auk 94(2).)

188. _____. 1976b. Some old records of TV tower kills from southwest Georgia. Oriole 41(4):45-51.

This article presents previously unreported data, originally collected by H. L. Stoddard, Sr. and R. A. Norris, on bird losses at the WALB and WRBL-WTVM towers in southwestern Georgia. On 28 visits to the WALB tower from 1959 to 1963, 613 birds (no total species count) were collected. Many of the carcasses were disturbed by scavengers and tall grass around the station grounds made it impossible to find birds over much of the area. Frontal activity and other weather conditions associated with kills on 12-13 September 1959, 7-8 September 1962, and 17-18 October 1962 are described. The species composition between kills at WALB and WCTV in Tallahassee, Fla. (about 80 km SW) were significantly similar on the first two nights, but not on the third. Species lists for the three dates at both towers are given. Two kills were recorded at the WRBL-WTVM tower: 18 birds on 23 April and 60 on 18 October 1962.

189. Crowell, J. B., Jr., and H. B. Nehls. 1972. The fall migration: northern Pacific coast region. Am. Birds 26(1):107-111.

A Leach's Petrel was killed at Brookings, Oreg. on 16 September 1971 when it struck a power pole.

190. Culver, D. E. 1915. Mortality among birds at Philadelphia, May 21-22, 1915. Cassinia 19:33-37.

Following a cold spell, on a foggy, rainy night, hundreds of birds were killed at the Philadelphia city hall tower. Common Yellowthroats dominated the list of casualties. Another kill occurred on the night of 17-18 October, and a list of these losses (29 birds, 12 species) is given.

191. Cunningham, R. L. 1964a. Fall migration: Florida region. Audubon Field Notes 18(1):24-28.

In September 1963, in Leon County, the largest kill ever (no data given) at the WFSU tower was reported, and 735 birds, including 80 Bobolinks, were killed at WCTV.

192. _____ 1964b. Spring migration: Florida region. Audubon Field Notes 18(4):442-446.

In Leon County, on 2 May, 207 birds, including 150 thrushes, were found dead at the WCTV tower; the WFSU tower contributed little during the spring.

193. _____. 1965. Fall migration: Florida region. Audubon Field Notes 19(1):28-33.

Following the drizzly, hazy night of 6 October 1964, 4707 birds (37 species) were found dead in the Indian River area, the result of low flying birds striking buildings, headlights and windshields; 98% were warblers (1354 Common Yellowthroats and 322 Blackpolls). (See Case et al. 1965 for more details.) Also, "moderate" tower kills were reported at Daytona Beach and St. Augustine, and 2000+ birds were killed during 6-8 October at two TV towers in Jacksonville; 95% were warblers (273 Blackpolls).

194. Dailey, N. S. 1978. Environmental aspects of transmission lines: a selected, annotated bibliography. Oak Ridge Natl. Lab. ORNL/EIS-122.

Included among the 663 entries are references to bird losses due to collisions and electrocutions at power transmission lines. The citations are indexed by author, location, taxon, and subject.

195. Danenhour, F. H. 1889. Birds killed by electric lights at Girard College, Philadelphia. Am. Nat. 23:823-824.

Migrants were frequently killed at the light towers on campus. A partial list of species killed (no numbers) is given.

196. Davis, W. B. 1940. Gas flares and birds. Condor 42(2):127.

In May 1939, birds fluttered like moths near gas flares in a Texas oil field.

197. Dawson, G. A., and P. L. Dalby. 1973. A Goshawk-thermopane encounter. Jack-Pine Warbler 51(3):128.

An immature male Goshawk struck a window and died on 25 October 1972 at Lansing, Mich.

198. de Miranda, F., and E. Osieck. 1971. Proposal with respect to goals and approach: how do we reduce the number of victims of high voltage lines? [in Dutch]. Vogeljaar 19(2):485-489.

Methods are suggested for the counting of dead birds in the vicinity of power lines. Frequent counts are recommended to reduce the effects of scavengers. Data taken should include specific injuries of victims, weather conditions, terrain, and bird use of the area.

199. DeSante, D. F., and D. G. Ainley. 1980. The avifauna of the South Farallon Islands, California. Stud. Avian Biol. 4.

In September 1971, a New Zealand Shearwater and several passerines were killed at the lighthouse on Farallon Island.

200. Devitt, O. E. 1967. The birds of Simcoe County, Ontario. Brereton Field Nat. Club, Barrie, Ont. 192 pp.

On pages 18 and 19, kills at the CKVR-TV tower at Barrie during 1960-67 are discussed. Numbers killed seemed to vary directly with the prevalence of fog and low ceiling during migration. In the seven years covered, 2632 birds (63 species) were collected. Yearly kill totals and number of species are given for the years 1960-67. Casualties were comprised mainly of thrushes, warblers, flycatchers and sparrows. A complete list of casualties is given in the appendix.

201. Devlin, J. M., and J. M. Wykoff. 1957. Observations on nocturnal bird accidents. Turtox News 35(10):232-233.

This is a brief discussion of the relationship between weather and kills at tall structures. Red bat mortality is mentioned.

202. Dexter, R. W. 1953. Electrocution of a Baltimore Oriole. Bird-Banding 24(3):109.

The bird apparently touched two wires simultaneously.

203. Dick, M. H., and W. Donaldson. 1978. Fishing vessel endangered by Crested Auklet landings. Condor 80(2):235-236.

On the night of 16 January 1977, thousands of Crested Auklets, apparently attracted by lights, struck a fishing vessel in the Kupreonof Strait, Alaska. At one point, the boat was in danger of capsizing due to the accumulation of dead birds. Turning off some of the boat's lights decreased the number of bird strikes. Such occurrences with seabirds are not uncommon in Alaskan waters, and several similar instances, including one involving over 1100 Whiskered Auklets, are described. Lighted platforms and gas flares associated with oil and gas development in the region pose possible new threats to seabirds.

204. Dickinson, L. E. 1957. Utilities and birds. Audubon Mag. 59(2):54-55, 86-87.

The author reviews the problem of bird strikes and electrocutions at power lines and cites examples of solutions to particular situations.

205. Diederich, J. 1977. Vogelverluste on Glasflachen des Athenaums in Luxemburg. Regulus 12(7):137-139.

Losses of 146 birds (34 species) at a plate glass window of a Luxemburg school are listed. Blackbirds, Turdus merula, and Blackcaps, Sylvia atricapilla, led the casualty list with 26 and 9, respectively.

206. Dilger, W. C. 1954. Electrocution of parakeets at Agra, India. Condor 56(2):102-103.

Rose-ringed Parakeets were frequently electrocuted on power lines at an Army base in the 1940's.

207. Dinesman, L. G. 1947. On the destruction of some birds in hitting telegraph wires [in Russian]. Zool. J. Moscow 26:171-176.

This was not seen. (The citation is from Zool. Rec., Aves, 1947.)

208. Dixon, C. 1897. The migration of birds: an attempt to reduce avine season-flight to law. Horace Cox, London. 2nd ed. 426 pp.

In chapter eight, "The Perils of Migration", the author discusses bird mortality at lighthouses and lightships. Generally, lightships are more attractive to birds than are lighthouses, and fixed white lights are more deadly than revolving or colored ones. Fog horns have been used successfully to prevent birds from striking lights. Several reports of mortality and bird behavior at British light stations are included. Telegraph wires, while too low to generally be a hazard to migrants, have been known to cause losses.

209. D'Ombrain, A. F. 1945. Migratory birds and overhead wires. Emu 45(2):173-174.

It is theorized that migrating shorebirds "become mystified by the bright city lights" which cause them to fly lower than usual, resulting in strikes at overhead wires. Two instances of such mortality in Austrialia are recounted.

210. Dorst, J. 1962. The migration of birds. Houghton Mifflin Co., Boston. 476 pp.

The problem of bird mortality due to collisions with man-made structures is mentioned in the introduction.

211. Drewien, R. C. 1973. Ecology of Rocky Mountain Greater Sandhill Cranes. Ph.D. Thesis. Univ. of Idaho, Moscow.

Collisions with power lines accounted for 36% of the observed mortality in the population that was studied.

212. Dunbar, R. J. 1949. Birds colliding with windows. Migrant 20(1):12-15.

The problem of bird strikes at windows is discussed. Most of the birds that hit windows survive.

213. _____. 1954. Bird mortality- Oak Ridge. Migrant 25(4):63-64.

On the morning of 7 October, about 1000 birds (22 species) were found on a parking lot at Oak Ridge, Tenn. Losses were attributed to collisions with overhead power lines, light towers, cars, and pavement. Most carcasses were found beneath the parking lot lights.

214. Dutcher, W. 1884. Bird notes from Long Island, N.Y. Auk 1(2):174-179.

Losses in spring and fall 1882 at the Fire Island lighthouse numbered 28 (14 species) and 228 (38 species), respectively. Casualties during spring 1883 totaled 45 (21 species) while fall losses were 517 (27 species), including 235 Blackpoll Warblers. In addition, about 160 birds, including 59 Blackpoll Warblers, were killed at the Shinnecock Bay lighthouse on 30 Sept. 1883. Some information on weather conditions is included.

215. _____. 1888. Bird notes from Long Island, N.Y. Auk 5(2):169-183.

At the Fire Island lighthouse, 595 dead birds (25 species) were collected on 23 Sept. 1887. The casualties included 356 Blackpoll Warblers.

216. Easterla, D. A., and R. E. Ball. 1973. The Rock Wren in Missouri. Wilson Bull. 85(4): 478-479.

The first Missouri record was found dead at a Maryville tower.

217. Eaton, S. W. 1967. Recent tower kills in upstate New York. Kingbird 17(3):142-146.

Tower mortality on the Alleghany Plateau is discussed. Several towers in the area are mentioned, and a list of 57 species (no numbers) found dead during 1956-66 is given. The author estimates that 10,000 songbirds are killed annually at area towers.

218. Edeburn, R. M. 1973. Great Horned Owl impaled on barbed wire. Wilson Bull. 85(4):478.

It had become impaled at the base of its left wing.

219. Edscorn, J. B. 1974. The fall migration: Florida region. Am. Birds 28(1):40-44.

The unusually low kill at the WCTV tower near Tallahassee in fall 1973 was attributed to very clear weather.

220. _____. 1975. The fall migration: Florida region. Am. Birds 29(1):44-48.

Included among the fall 1974 casualties at the WCTV tower were 971 birds on the night of 17 October.

221. _____. 1976. The fall migration: Florida region. Am. Birds 30(1):54-58.

Fall 1975 migration records from the WCTV tower are mentioned.

222. _____. 1977. The autumn migration: Florida region. Am. Birds 31(2):166-169.

The fall 1976 kill at the WCTV tower near Tallahassee was much less than usual, the largest single kill being 66 birds on 18 October. At the WCKS tower at Cape Canaveral, 90 birds were found dead on 11 October.

223. Elder, W. H., and J. Hansen. 1967. Bird mortality at KOMU-TV tower, Columbia, Missouri, fall 1965 and 1966. Bluebird 34(1):3-6.

A list of 851 birds (36 species) found in the two seasons is given, with age and sex data on seven species from 1966. Some comparisons with data from other towers are made.

224. Elliot, J. J. 1954. Region 10- Long Island. Kingbird (4):118-119.

This is a brief summary of October kills at Mitchell Field (230+), Westhampton Air Force Base (2000), and the Empire State Building (100). The Blackpoll Warbler was the most abundant species killed.

225. Eltringham, S.K. 1963. The British population of the Mute Swan in 1961. Bird Study 10(1): 10-28.

Among a sample of 400 recoveries of banded swan, collision with overhead wires (95) was the most frequently reported cause of death. Collisions with vehicles and buildings numbered 20. Power outages due to collisions by swan are increasing, but they are a minor factor compared to other causes. Reduction in outages is being effected by changing cable configurations from triangular to flat, using game corks on the wires as warning devices, and insulating wires.

226. Emerson, W. O. 1904. Destruction of birds by wires. Condor 6(2):37-38.

The author cites mortality of shorebirds and a Black Rail in the San Francisco Bay area by flying into utility wires, particularly across salt marshes and evaporating ponds. He also mentions the death of a Great Horned Owl on a barbed wire fence.

227. Emery, R. P., and R. E. Woodruff. 1968. Spring migration: northeastern maritime region. Audubon Field Notes 22(3):505-507.

Hundreds of birds, mostly White-throated Sparrows, were found dead at the Prudential Center Building, Boston, Mass. on 4 May.

228. English, A. O. 1961. Destruction of birds in migration. Raven 32(5&6):66-67.

At the Roanoke, Va. airport ceilometer, 92 birds (22 species) were killed on 1-2 October 1960. A species list is given.

229. Evans, G. 1964. Birds at Bardsey Lighthouse-1964. Bardsey Bird Field Obs. Rep. 12:47-49.

From March to December, 1018 birds were reported killed. Blackbirds and Willow Warblers were the most common casualties.

230. _____. 1965. Lighthouse report, 1965. Bardsey Bird Field Obs. Rep. 13:46-49.

For the year, 69 losses, including 19 Starlings, were reported.

231. _____. 1966. Lighthouse report 1966. Bardsey Bird Field Obs. Rep. 14:39-41.

From March to October, 331 birds were reported killed. Redwings (Turdus iliacus) were prominent among the casualties.

232. _____. 1967. Lighthouse report. Bardsey Bird Field Obs. Rep. 15:41-42.

This was not seen. The citation is from Zool. Rec., Aves, 1967.

233. Farnham, C. B., Jr. 1971. Snipe impaled on cable. Kingbird 21(1):10-11.

In New York, a Common Snipe died when its lower mandible pierced the insulation of a telephone wire and the bird couldn't free itself.

234. Feehan, J. 1963. Destruction of birdlife in Minnesota- Sept. 1963. II. Birds killed at the Ostrander television tower. Flicker 35(4):111-112.

A list of 1250 birds (28 species) killed on the cloudy night of 19 September is presented.

235. Ferren, R. 1959. Mortality at the Dow Air Base ceilometer. Maine Field Nat. 15(4):113-114.

Two incidents at Bangor, Me. are reported: 45 birds (16 species) on the night of 30-31 August and 32 (11 species) on 30 September- 1 October. Thousands of birds were seen in the beam on the first occasion, but fewer were observed the second time when the beam was turned off at 0230 to prevent further mortality. The call notes of many species were noted, including Lesser Yellowlegs and Spotted Sandpiper.

236. Finch, D. W. 1970. The fall migration: northeastern maritime region. Audubon Field Notes 24(1):13-21.

On the night of 10 September 1969, 112 birds were killed at the Gannet Rock, New Brunswick lighthouse. At the Prudential Center in Boston, Mass., kills occurred on 22 October (380 birds) and 14 November (179).

237. _____. 1971. The fall migration: northeastern maritime region. Am. Birds 25(1):24-31.

A kill at the Prudential Center Building in Boston, Mas. on the night of 15-16 September 1970 is described as "very modest".

238. _____ 1973a. The fall migration: northeastern maritime region. Am. Birds 27(1):24-30.

A casualty at the Cape Sable, Nova Scotia lighthouse is mentioned.

239. _____. 1973b. The spring migration: northeastern maritime region. Am. Birds 27(4):748-751.

On the night of 2-3 May, 80 birds, mostly White-throated Sparrows, were killed at the Prudential Center Building in Boston, Mass.

240. Fink, L. C. 1970. Birds in downtown Atlanta- 1969. Oriole 35(1):1-9.

Birds observed live or found dead at two buildings are listed. One building is 452 feet tall, dark and unlighted; the other is 374 feet tall, white and brightly lit.

241. _____. 1971. Birds in downtown Atlanta- spring, 1970. Oriole 36(1):2-6.

Additional sight and kill records (primarily warblers and sparrows) from two skyscrapers are noted.

242. Fink, L. C., and T. W. French. 1971. Birds in downtown Atlanta- fall, 1970. Oriole 36(2&3):13-20.

At the white, lighted Trust Building, 29 birds were killed. At the darker, unlighted Equitable Building, 609 were collected, 461 following the nights of 28 and 29 September. Warblers and sparrows headed the kill list.

243. Fisher, H. I. 1966. Midway's deadly antennas. Audubon Mag. 68(4):220-223.

The effects of the maze of antenna and guy cables on the island's colony of Laysan Albatrosses are discussed. At least 2901 were killed in a 7-month period. Damage to other species is also mentioned.

244. _____. 1970. The death of Midway's antennas. Audubon Mag. 72(1):62-63.

The antennas on Midway Island that were responsible for the deaths of more than 3000 Laysan Arbatrosses in 1964-65 were demolished, and the hazard no longer exists.

245. Fitzner, R. E. 1975. Owl mortality on fences and utility lines. Raptor Res. 9(3&4):55-57.

In Washington and Idaho during the winter of 1973-74, the author found one Great Horned Owl and one Short-eared Owl impaled on barbed wire fences and two Short-eared Owls hanging from overhead utility wires which they had struck.

246. Fjetland, C. 1974. Trumpeter Swan management at Lacreek National Wildlife Refuge. Proc. Pap. Trumpeter Swan Soc. Conf. 3:35-44.

Telephone lines have been a definite source of mortality at this South Dakota refuge, accounting for five or six deaths since 1964. The telephone lines are now being buried and it is hoped that the same thing can be done to the electrical lines to reduce the hazard to swans.

247. Fobes, C. B. 1956. Bird destruction at ceilometer light beam. Maine Field Nat. 12(4):93-95.

About 60 birds (seven species) were killed at the Portland, Me. airport on an overcast night. The beam was turned off to prevent further deaths.

248. Fodor, T. 1967. Frequent appearance of swans in the transdanubian region [in Hungarian, English translation.] Aquila 73-74:175-176, 192.

One swan hit an overhead cable.

249. Fog, J. 1970. Om andefugle contra elledninger [in Danish, English summary]. Flora Fauna 76(4):141-144.

Waterfowl are sometimes killed flying into 150 kV power lines (22 mm diameter, 30 m high). Birds flew under, over and between the wires and also rested and fed beneath.

250. Forbush, E. H. 1912. A history of the game birds, wild-fowl and shore birds of Massachusetts and adjacent states. Massachusetts State Board Agric. 700 pp.

Lighthouses, electric light towers and wires, and telegraph wires kill thousands of birds each year, especially during nocturnal migration. Fortunately, most game birds are unaffected by such collisions, but rails and Woodcock which fly low in migration suffer severely. High wire fences kill many grouse which also collide frequently with houses set among trees.

251. Fox, N. C. 1977. N. Z. Falcons taking poultry. Notornis 24(2):140.

Of two New Zealand Falcons examined, one appeared to have been injured on a barbed-wire fence and the other appeared to have struck telephone wires. The author also observed non-lethal collisions of a Grey Duck with a telephone wire and an Australasian Harrier with power lines.

252. French, T. W. 1972. Sharp-tailed Sparrow found dead in Atlanta. Oriole 37(2&3):14-15.

This male was one of nine collected at a building on 17 May.

253. _____. 1973. Notes from Atlanta- 1971 and 1972. Oriole 38(4):39-43.

In these two years, almost daily checks at two building produced 1296 casualties (83 species). The author lists and discusses several of the more unusual records (Fink and French 1971).

254. Gander, F. F. 1930. A Black Rail leaves the salt marsh. Condor 32(4):211.

On 30 August 1929, a Black Rail was found dead near the towers of the U.S. Naval Radio Station, east of San Diego, Calif.

255. Ganier, A. F. 1954a. Bird casualties at Smyrna airport. Migrant 25(1):11.

Eighteen birds (eight species) were killed on the night of 5 October 1953 at the ceilometer at the Army Air Base near Smyrna, Tenn.

256. _____. 1954b. Bird mortality- Shelbyville. Migrant 25(4):61-62.

On the chilly night of 6 October, about 300 birds died as a result of being attracted to street lights in Shelbyville, Tenn. Many probably died through collisions with obstructions while others may have died from exposure, having been unwilling to leave the lighted area. (Mortality in other areas of Tennessee during early October 1954 is reported in the 1954 articles of Dunbar, Herndon, Laskey, Tanner, and West.)

257. _____. 1962. Bird casualties at a Nashville T-V tower. Migrant 33(4):58-60.

Three kills at the 1369-foot WSM-TV tower in September and October resulted in losses of 336 dead birds (39 species) and 2 red bats. Weather data are included.

258. _____. 1963. A Kentucky bird-fall in 1962. Migrant 34(2):34-35.

On a foggy September night, 270 birds (30 species) were killed by flying into windows (Carpenter and Lovell 1963).

259. _____. 1966. Some facts learned from nocturnal migration. Migrant 37(2):27-34.

Twenty-six published lists of bird kills at towers and ceilometers are tabulated. Of the total of 16,118 casualties, Ovenbirds accounted for 15.5% (2513), Tennessee Warblers 12.1% (1933), Red-eyed Vireos 8.8% (1405), and Magnolia Warblers 8.8% (1418).

260. Gastman, E. A. 1886. Birds killed by electric light towers at Decatur, Ill. Am. Nat. 20:981.

Probably 1000 birds were killed by the light towers on 28-29 September; 10 species are listed.

261. Gauthreaux, S. A., Jr. 1972. The changing seasons. Am. Birds 26(4):731-736.

"Relatively few reports of migration disasters were received this spring. . . ."

262. _____. 1973. The changing seasons. Am. Birds 27(4):743-748.

The spring migration casualties at towers and other structures are mentioned and characterized as "few".

263. George, W. 1963. Columbia tower fatalities. Bluebird 30(4):5.

On the nights of 20 and 21 September 1963, 941 birds (46 species) were killed at the KOMU-TV tower, Columbia, Mo. A species list is given.

264. Gerstenberg, R. H. 1972. A study of shorebirds (Charadrii) in Humboldt Bay, California - 1968 to 1969. M.S. Thesis. Humboldt State College, Arcata, Calif. 207 pp.

More than 150 Northern Phalaropes were killed on 6 May 1969 by striking electric wires along the coast near Trinidad, Calif. Similar incidents, involving fewer birds occurred on 6 May 1967 and 7 May 1971.

265. Giller, F. 1960. Eine moderne "Vogelfalle". Ornithol. Mitt. 12(8):152-153.

Bird kills at large windows during summer and fall 1959 are reported.

266. Glue, D. E. 1971. Ringing recovery circumstances of small birds of prey. Bird Study 18(3):137-146.

Kestrels and Sparrowhawks were more prone to collisions with overhead wires, cables and buildings than were Barn, Tawny, and Little Owls.

267. Gochfeld, M. 1973. Confused nocturnal behavior of a flock of migrating Yellow Wagtails. Condor 75(2):252-253.

Early in the overcast morning of 8 October 1967, at Tam Ky, Viet Nam, about 30 Yellow Wagtails repeatedly took off and landed on a fence around a brightly-lit compound. This behavior is discussed in the context of previous reports of the attraction of birds to lighted objects.

268. Goddard, S. V. 1975. Special studies, number and composition of the birds killed by striking the transmission lines from the Prairie Island Nuclear Generating Plant. Northern States Power Co. Ann. Rep. Vol. 2. 2.7.3.2.:1-6.

From two spring and one fall search under 5 km of line, 105 birds (26 species) were recovered. The five most abundant species were the Starling (17), Red-winged Blackbird (16), Mourning Dove (15), American Robin (8), and American Coot (7). A list of 1974 and 1975 casualties is given.

269. _____. 1976. Prairie Island Nuclear Generating Plant environmental monitoring and ecological studies program, 1976 annual report of ecological studies: number and composition of birds killed by striking transmission lines from the Prairie Island Nuclear Generating Plant. Northern States Power Co. Ann. Rep. Vol. 2. 17 pp.

One fall and two spring checks for dead birds were made under 4.6 km of power line each year 1974-76. Yearly losses totalled 96, 25, and 85 birds, respectively. Starlings, Mourning Doves, Red-winged Blackbirds, Common Grackles, and Brown-headed Cowbirds accounted for over 50% of the losses. A total kill list of the 45 species found dead is provided.

270. _____. 1977. Number and composition of birds killed by striking transmission lines from the Prairie Island Nuclear Generating Plant. Special studies, Prairie Island Nuclear Generating Plant environmental monitoring program. Northern States Power Co. Ann. Rep.

During eight searches in spring and fall 1977, 89 birds of 24 species were collected. The 4-year total mortality at this site near Red Wing, Minn. was 385 birds (49 species), the most common casualties being Mourning Doves (62), Red-winged Blackbirds (57), Common Grackles (31), Brown-headed Cowbirds (23), and Ring-necked Pheasants (19). Largest numbers of losses were found in areas perpendicular to the migration corridor of the Mississippi River. Six of the eight most commonly killed species nest in the area. The recorded mortality was a minimum estimate due in part to insufficient searching and the actions of scavengers.

271. Goddard, S. V., and J. W. Richardson. 1974. Prairie Island Nuclear Generating Plant, environmental monitoring program. Northern States Power Co. Ann. Rep. pp. 841-1051.

Among the impacts studied, was bird mortality at transmission lines north and west of this power plant near Red Wing, Minn. On 21 April, 23 May and 13 September six to ten observers searched under a total of 5 km of line. Total spring losses were 75 birds (19 species) compared to 21 (10 species) in the fall. Most commonly killed species were the Mourning Dove (10), Starling (9), Brown-headed Cowbird (9), Sora (8), Common Grackle (7), Ring-necked Pheasant (5), and Wood Duck (3). The mortality is a minimum estimate in that scavengers may have removed other carcasses. A list of the losses for each search date is given. Losses were concentrated where the power lines were perpendicular to the major migration corridor up the Mississippi River Valley.

272. Gollop, M. A. 1965. Bird migration collision casualties at Saskatoon. Blue Jay 23(1):15-17.

During 1961-64, at Saskatoon, Sask., 543 dead birds and one red bat were collected at several towers and 15 birds were found dead beneath power lines. Species lists are given.

273. Goodpasture, K. A. 1963a. Age, sex, and wing length of tower casualties: fall migration, 1962. Bird-Banding 34(4):191-199.

An analysis of 316 birds (24 species) killed at two Nashville, Tenn. towers is presented. In September, 16.5% of the warbler skulls were pneumatized, compared to over 50% in October. Tennessee Warblers displayed clear sexual dimorphism in wing length.

274. _____. 1963b. Age and sex determination of tower casualties, Nashville, 1963. Migrant 34(4):67-70.

Age and sex data from fall kills at two Nashville towers are presented.

275. _____. 1974a. Fall 1972 television tower casualties in Nashville. Migrant 45(2):29-31.

At the WSM and WSIX towers, 556 dead birds (58 species) were collected during the season, the lowest fall total here since 1967. The kills were associated with low ceilings and the passage of cold fronts. On 18 October, 141 birds were found at the WSM tower, but none were recorded at WSIX on that date. Complete species lists are given.

276. _____. 1974b. Fall 1973 television tower casualties in Nashville. Migrant 45(3):57-59.

Near daily checks of the WSM and WSIX towers in September and October resulted in 165 casualties (42 species), the lowest seasonal total since regular monitoring began. Weather was generally mild throughout the fall. Following a clear night, 49 dead birds were collected on 6 October. The WSM tower was recently painted with bright orange paint and the guy wires with aluminum paint, but it is doubtful if this had any effect on the kill. Lists of the losses are given.

277. _____. 1975. Nashville television tower casualties, 1974. Migrant 46(3):49-51.

A new low (123 birds, 34 species) in fall casualties was recorded at the WSM and WNGE (formerly WSIX) towers. As in fall 1973, the weather was "without notable nocturnal violence or stormy force." No clear explanation of the low kills in 1973 and 1974 was obvious, but increased scavenger activity may have been partially responsible. A kill of about 700 birds on 15 September was reported at a tower in Decatur, Ala., about 100 miles south of Nashville. Lists of the Nashville kills are given.

278. _____. 1976. Nashville television tower casualties, 1975. Migrant 47(1):8-10.

Casualties numbered 513 (53 species) at the WSM and WNGE towers in fall 1975. The weather was generally mild, with fronts of low intensity. Warblers (22 species) accounted for two-thirds of the losses. Cats were noticeable scavengers. A complete kill list is given.

279. Goodwin, C. E. 1971. The fall migration: Ontario. Am. Birds 25(1):49-54.

On the night of 13-14 September 1970, "extensive casualties" (mostly Ovenbirds and other warblers) were recorded at London, Ont. TV towers, and 136 birds were killed at the 1000-foot Toronto-Dominion Centre.

280. _____. 1973a. The fall migration: Ontario. Am. Birds 27(1):49-56.

In 1972, the floodlit chimney of the Lennox power plant, Kingston, Ont. killed 1145 birds on 12 September and 1531 (361 Common Yellowthroats) on 19 September. (See Weir 1972 for more details.)

281. _____. 1973b. The spring migration: Ontario. Am. Birds 27(4):765-769.

Over 1000 birds were killed at the Long Point lighthouse during 22-26 May, with 966 (42 species) on 23 May alone. On 28 May, 127 birds died at the Lennox smokestack even with the floodlights off.

282. _____. 1974. The fall migration: Ontario- western New York region. Am. Birds 28(1):44-48.

A kill at the chimney of the Lennox, Ont. power plant on 9 August 1973 included a Bay-breasted and a Mourning Warbler. (See Weir 1973b for more details.)

283. _____. 1975. The fall migration: Ontario region. Am. Birds 29(1):48-53.

During fall 1974, kills at the Lennox power plant chimney and the Barrie and London TV towers totaled 7550 birds. Bay-breasted Warblers (1359), Red-eyed Vireos (1129), Ovenbirds (1038), and Magnolia Warblers (920) were the species most commonly killed.

284. _____. 1977a. The autumn migration: Ontario region. Am. Birds 31(2):169-173.

Brief mention is made of a kill at the Long Point lighthouse.

285. _____. 1977b. Spring migration: Ontario region. Am. Birds 31(5):993-996.

On 17-18 May, 422 birds of 37 species were killed at the Long Point, Ont. lighthouse. Principal species killed were Ovenbirds, Swainson's Thrushes, Veeries, and Common Yellowthroats.

286. Graber, R. R. 1962. Fall migration: middlewestern prairie region. Audubon Field Notes 16(1):35-37, 41-43.

Four tower kills were reported in fall 1961: 36 at Decatur, Ill. on 13-14 September; 233 (25 species) on 22-23 September and 87 on 23-24 September at Rockford, Ill.; and 77 (25 species) on 25-26 September at Columbia, Mo.

287. _____. 1968. Nocturnal migration in Illinois- different points of view. Wilson Bull. 80(1):36-71.

This is an extensive analysis of nocturnal migration by means of radar, aural recordings, field observations, and tower kills. The kills occurred near Champaign in late September 1957-62 and totalled 1500 birds (41 species). Complete lists of kills are given, and the nature of bird mortality at towers is discussed.

288. Graber, R. R., and J. W. Graber. 1962. Weight characteristics of birds killed in nocturnal migration. Wilson Bull. 74(1):74-88.

Differences in gross weights and weights of organs with sex and age were noted in 469 specimens (21 species) killed in September 1958-60 at a tower near Champaign, Ill.

289. _____. 1965. Variation in avian brain weights with special reference to age. Condor 67(4):300-318.

The authors discuss the technique of skulling and analyze brain weights with respect to age and sex for several species obtained in tower kills near Champaign and Springfield, Ill. on 24-25 September 1962.

290. Graff, G. S. 1954. Migration tragedy. Inland Birdbanding News 26(6):39-40.

On the cool, misty night of 5 October, 1887 birds (63 species) were killed at the 700-foot KOMU-TV tower near Columbia, Mo. Common Yellowthroats (354) and Gray Catbirds (313) were the most commonly killed species. A complete list of the kill is given.

291. Graham, R. 1916. Carolina rail accidentally killed. Oologist 33(11):187.

A Sora was found dead on 29 September in Ft. Worth, Tex. evidently killed by striking a telephone wire.

292. Gramlich, F. J. 1973. Bird mortality - microwave towers. U.S. Fish Wildl. Serv. Unpubl. rep. 2 pp.

On 14 August, two transmitting stations in Maine were visited to collect information on possible bird mortality. The 1600-foot WGAN-TV tower at Raymond showed no signs of recent mortality, but hundreds of birds are sometimes killed during the spring and fall migrations. At the 1290-foot WCSH tower at Sebago, about 200 warblers, 100 thrushes, as well as sparrows and kinglets were killed on the night of 12-13 August amidst fog and light rain. The author believes the towers themselves are more important than guy wires in causing losses, because very few casualties were found under guy wires. Physical features of the towers, their lighting schemes, and the surrounding topography are described.

293. Green, J. C. 1962. Destruction of migrating birds at the Duluth ceilometer. Flicker 34(1):3-6.

This report of an estimated 1000 casualties (190 of 28 species actually listed) is the first from Duluth, Minn. Higher birds circled in the beam, and lower ones flew erratically around and through it. Deaths were attributed to collisions with other birds.

294. _____. 1963. Destruction of birdlife in Minnesota- Sept. 1963. III. Notes on kills at Duluth on September 18/19. Flicker 35(4):112-113.

At the Duluth ceilometer, 92 birds of 17 species were killed. The light was turned off at 2100 to prevent further losses. Casualties totalled 35 (12 species) at the WDSM tower.

295. _____. 1964. Fall migration: western Great Lakes region. Audubon Field Notes 18(1): 33-34, 39-42.

During 18-20 September 1963, extraordinary numbers of migrants passed through the Minnesota- Wisconsin area resulting in several large kills. At Eau Claire, Wis., over 10,000 birds of 45 species were collected at a tower (Kemper et al. 1964) where mortality was estimated to have exceeded 30,000. At Ostrander, Minn., mortality at a tower was estimated to be 1500 based on 250 birds actually collected (Feehan 1963). In Lewisville, Minn., 924 birds of 47 species were collected at a tower (Janssen 1963), and about 100 birds were killed at a ceilometer at Duluth, Minn. (Green 1963). A slow-moving cold front with overcast skies was associated with these incidents.

296. _____. 1965. Fall migration: western Great Lakes region. Audubon Field Notes 19(1): 37-41, 44.

In 1964, on an overcast night, hundreds of birds were seen in the beam of the Duluth, Minn. ceilometer, but no mortality resulted, perhaps because the light was turned off at midnight when the flight was heaviest.

297. Green, J. C., and J. P. Perkins. 1964. Some notes on the fall 1964 migration of vireos and warblers. Loon 36(4):127-129.

On the drizzly, overcast night of 7-8 September, hundreds of migrants were attracted to the lights of an ore-carrying steamer on Lake Superior. The birds struck rigging and cabins, and according to the captain, "Birds were being drawn into the ventilating fans and chopped birds were raining into the firehold and engine room." This major migratory movement coincided with the greatest daily mist-net totals of the season at Ely and Hibbing, Minn. (Perkins 1964).

298. Gregory, H. 1975. Unusual fall tower kill. Bluebird 42(4):9-10.

On the night of 14-15 October, over 98 birds of 20 species were killed at four towers in Missouri and Kansas. The KCMO tower in Kansas City, Mo. accounted for 67 casualties including 32 Mourning Doves. The incidents were unusual because KCMO is free-standing (i.e. no guy wires), over half the casualties were Mourning Doves, and the cloud ceiling was rather high (5000 - 10,000 feet). A list, by tower, of 86 casualties (20 species) is given.

299. Griepentrog, E. A. 1929. Wire mortalities. Oologist 46(2):24.

In Oregon, during 1926-28, the author noted several instances of bird collisions with telephone wires and barbed-wire fences. Species that struck telephone wires included Common Snipe, Western Gull, and Mourning Dove, while a Gray Partridge and an American Robin struck barbed-wire fences.

300. Griffin, W. W. 1956. Unexpected birds killed at Atlanta area ceilometers. Oriole 21(2):21-22.

Following the night of 26-27 September 1955, 556 birds of 36 species were collected at area ceilometers and TV towers. Several species unusual for that area are noted.

301. Grinnell, J., H. C. Bryant, and T. I. Storer. 1918. The game birds of California. Univ. of California Press, Berkeley. 642 pp.

Two instances of Black Rail mortality are mentioned. One was found dead on a Santa Cruz, Calif. street in September 1903 after hitting an electric wire (Emerson 1904) and another was killed at the Point Loma Light, near San Diego, on 4 August 1876.

302. Griscom, L. 1955. The changing seasons. Audubon Field Notes 9(1):4-7.

The author notes that "severe mortality" occurred at towers, buildings, and airport ceilometers in eastern and midwestern states during fall 1954.

303. Gross, W. A. O. 1935. The life history cycle of Leach's Petrel (Oceanodroma leucorhoa leucorhoa) on outer sea islands of the Bay of Fundy. Auk 52(4):382-399.

Many petrels died from fluttering around a lighthouse beacon until they became exhausted and crashed to the ground.

304. Gunn, W. W. H. 1956. Spring season: Ontario- western New York region. Audubon Field Notes 10(4):329-331.

"Several bushel baskets of birds", mostly warblers, were killed at a grain elevator in Ontario on the night of 12 May.

305. Hall, G. A. 1965. Fall migration: Appalachian region. Audubon Field Notes 19(1):34-37.

No details are given concerning "large numbers of birds killed at a television tower near Knoxville, Tenn." in 1964.

306. _____. 1966. Fall migration: Appalachian region. Audubon Field Notes 20(1):41-45.

Several incidents were reported in fall 1965: a TV tower near Charleston, W.V. "produced a steady number of dead birds"; on the foggy night of 24-25 September, many birds ("over a truckload") were killed at a microwave relay tower and a gasoline compressor station atop a mountain near Buckhannon, W.V.; and on 1 October, over 1800 dead birds were found at a ski resort near Gatlinburg, Tenn. (Savage 1965).

307. _____. 1967. Fall migration: Appalachian region. Audubon Field Notes 21(1):33-36.

A Charleston, S.C. tower kill is mentioned.

308. _____. 1968. Fall migration: Appalachian region. Audubon Field Notes 22(1):37-40.

On 7 October 1967, 380 birds of 42 species were killed at a tower atop a ridge near St. Alban's, W.V.

309. _____. 1971. The fall migration: Appalachian region. Am. Birds 25(1):57-61.

In 1970, near Beverly, Ohio, 68 birds, mostly warblers, were found dead at the foot of a tall smokestack.

310. _____. 1972. The fall migration: Appalachian region. Am. Birds 26(1):62-66.

Frequent foggy weather in 1971 resulted in kills at the stacks of the Beverly, Ohio power plant and at the lighted windows of a motel ("several hundred birds") at Rockford Gap atop the Blue Ridge in Virginia.

311. _____. 1973. The fall migration: Appalachian region. Am. Birds 27(1):59-63.

On 30 September 1972, following the passage of a cold front, but under clear skies, 1801 birds of 44 species were killed at a tower complex on Holston Mt., near Elizabeth, Tenn. (Herndon 1973).

312. _____. 1974. The fall migration: Appalachian region. Am. Birds 28(1):52-56.

On the night of 29-30 September 1973, many birds were killed or stunned flying into motel windows at Rockford Gap atop the Blue Ridge in Virginia. About 2000 birds were killed at the 1103-foot unilluminated smokestack of a Cheshire, Ohio power plant on the rainy, foggy night of 30 September.

313. _____. 1975. The fall migration: Appalachian region. Am. Birds 29(1):57-61.

In fall 1974, tower kills were reported from Knoxville, Tenn. (no data) and Youngstown, Ohio (268 birds). (See Anon. 1975 for details of the Ohio incident.)

314. _____. 1976. The fall migration: Appalachian region. Am. Birds 30(1):67-71.

In fall 1975, 1031 birds were collected at a Youngstown, Ohio TV tower (Bartolo 1976) and 364 were found at a Pittsburgh, Pa. tower. Near Morgantown, W.V., a small kill occurred at a mountaintop fire tower. There was partial correspondence between the tower kills and other migration indicators, such as banding results.

315. _____. 1977. The autumn migration: Appalachian region. Am. Birds 31(2):176-179.

About 200 birds died at the Youngstown, Ohio tower in fall 1976, and a kill was reported (no data) at a Morgantown, W. V. fire tower on 2-3 October.

316. Hannum, G., W. Anderson, and M. Nelson. 1974. Power lines and birds of prey. Paper presented at Northwest Electric Light & Power Assoc. Eng. and Operating Conf. Yakima, Wash. 22 April.

The Idaho Power Company's program to reduce power line electrocutions of birds of prey is presented (Nelson 1975, Nelson and Nelson 1976). Included are sketches of design changes of poles and conductors to make them safe.

317. Hansen, L. 1954. Birds killed at lights in Denmark 1886-1939 [in English, Danish summary]. Vidensk. Medd. Dan. Naturhist. Foren. 116:269-368.

In this paper the author presents a comprehensive summary of bird mortality at Danish lighthouses and lightvessels during the period 1886-1939. In the 54 years, about 55,800 birds were sent to the Zoological Museum at the University of Copenhagen, and another 40,700 were reported killed but not collected. Topics discussed include: differential susceptibility among birds to be killed at lights, sex and age ratios, differences between spring and fall migrations, differential migration by age and sex, seasonal distribution of migrants, and variations in mortality among the lights. Twelve lightvessels accounted for 50% of the spring losses and 40% of the fall losses. Recently, many gas and kerosene lamps have been replaced by electric lights which have a smaller vertical illumination which may be why mortality has decreased considerably. Illuminating one of the lighthouses resulted in increased mortality. An annotated list of the 190 species killed and bar graphs showing the monthly kill for 94 species are provided. Also included are a list of the losses at each light station and maps showing the distributions of losses of some species at the most lethal lights.

318. Harrison, J. 1963. Heavy mortality of Mute Swans from electrocution. Wildfowl Trust Ann. Rep. 14:164-165.

During a 2-month period in spring 1962, 30% (21 birds) of local swan flocks at Romney Marsh, Kent, England were killed along 1/4 mile of power lines 30 feet high. No distinction is made between deaths by electrocution or collision.

319. Harvie-Brown, J. A., and J. Cordeaux. 1880. Report on the migration of birds in the autumn of 1879. Zoologist 4(41):161-204.

Included are reports of strikes at lighthouses along the coasts of Scotland and England. Kills usually occurred on overcast nights, and birds left the vicinity of the lights when stars reappeared or when morning came.

320. Harwin, R. M. 1971. White Stork: longevity record. Ostrich 42(1):81.

In Rhodesia, a White Stork struck a power line and died in November 1969, 17 years after it had been banded as a nestling.

321. Hatch, D. R. M. 1966. Fall migration: northern Great Plains region. Audubon Field Notes 20(1):61-64.

Mention is made of "large kills" of warblers, thrushes and sparrows at Winnipeg, Manitoba TV towers in late September 1965.

322. _____. 1967. Fall migration: northern Great Plains region. Audubon Field Notes 21(1): 47-51.

A tower kill at Saskatoon, Sask. on 10-11 September 1966 is mentioned.

323. _____. 1969. Fall migration: northern Great Plains region. Audubon Field Notes 23(1): 70-74.

On the nights of 17 and 18 September 1968, 18 species of warblers were among the casualties at a Starbuck, Manitoba tower.

324. Hatler, D. F., and R. W. Campbell. 1975. Notes on spring migration, including sex segregation, of some western Savannah Sparrows. Syesis 8:401-402.

Early on the mornings of 2 and 3 May 1972, during a period of heavy fog, 57 birds of five species were killed at the Cape Scott lighthouse, Vancouver Island, B.C. Among the casualties were 30 Savannah Sparrows (all males) and 19 Fox Sparrows. The sample of Savannah Sparrows reflects a segregated migration.

325. Hendrickson, J. R. 1949. A hummingbird casualty. Condor 51(2):103.

During an aerial display, a male Allen's Hummingbird struck a telephone wire and was killed in California.

326. Herndon, L. R. 1954. Bird mortality- Johnson City. Migrant 25(4):65-67.

About 1000 birds were killed at the WJHL-TV tower at Johnson City, Tenn. during the cloudy night of 6-7 October 1954. The tower is 632 feet tall and is atop a ridge 200 feet above the surrounding landscape.

327. _____. 1957. Television tower casualties, Johnson City. Migrant 28(4):56-57.

On 29 September, 214 birds of 29 species were found dead at the WJHL-TV tower. A list of the casualties is given.

328. _____. 1962. A Texas bird-fall. Migrant 33(4):60-61.

This is an account taken from the newsletter of the Texas Ornithological Society relating the deaths of about 6000 birds at the ceilometer of the Laughlin Air Base, San Angelo on 27 September. Among the unusual casualties were 4200 Mourning Doves, 1 Poor-will and 1 White-necked Raven. (See Webster 1963 for other details.)

329. _____. 1973. Bird kill on Holston Mountain. Migrant 44(1):1-4.

At two installations near Elizabethton, Tenn., 1801 birds of 44 species were killed by colliding with floodlit buildings and two small (125 and 85 feet) towers. The weather was foggy with northwesterly winds on 30 September and 1 October 1972 when the losses occurred. A kill list is given.

330. Herren, H. 1969. The status of the Peregrine Falcon in Switzerland. Pages 231-238 in J. J. Hickey, ed. Peregrine Falcon populations - their biology and decline. Univ. of Wisconsin Press, Madison.

Of 14 dead Peregrine Falcons examined between 1952 and 1965, 5 had collided with wires. Overhead wires are the main cause of Eagle Owl fatalities and have contributed to the extirpation of the species in much of its former range in Switzerland.

331. Heye, P. L. 1963. Tower fatalities. Bluebird 30(1):7.

Over 300 birds of 47 species are listed from the kill at the KFVS-TV tower in Cape Girardeau, Mo. during fall 1962.

332. Hickey, M. B. 1960. Migrants at airport ceilometers. Passenger Pigeon 22(1):23-26.

In late May 1952, hundreds of birds were observed milling near the base of the cloud ceiling in the beam of a ceilometer at Madison, Wis. Only 15 casualties of 10 species were collected. Calls of Green Herons, Black Terns, Spotted and Solitary Sandpipers and others were heard. In October 1959, 117 birds of 24 species were found dead at the same site following a cloudy night.

333. Hiltunen, E. 1953. On electric and telephone wire accidents in birds [in Finnish, English summary]. Suomen Riista 8:70-76, 222-223.

Losses of gamebirds, mostly Capercaillie and Blackgame (Black Grouse), through wire strikes occur primarily in the fall when fog and rain are frequent. Of 225 observed strikes, 76.8% were fatal. Over 76% of the accidents occurred at twilight.

334. Holt, E. G. 1920. Bachman's warbler breeding in Alabama. Auk 37(1):103-104.

Reference is made to a Bachman's Warbler killed at the Sombrero Key, Fla. lighthouse (Merriam 1887).

335. Hordy, N. 1970. Fatal dinner. Thunder Bay Field Nat. Club News Letter 24(1):11.

A Great Horned Owl perched on a utility pole insulator with a prey item. In trying to obtain better footing, the owl touched a 4160 volt conductor and was electrocuted. (Citation and summary from Wild. Rev., June 1970, 138:73.)

336. Hosford, H. V. 1962. Migrant bird casualties at TV towers. Manitoba Nat. Hist. Soc., Ornithol. Sec. Newsl. 1:5-8.

The author outlines the kinds of data that should be taken at tower kills and gives details of the losses (74 birds, 28 species) at a tower in Winnipeg on 23-24 September and 7-8 October.

337. Hoskin, J. 1974. Casualties at the CKVR TV tower. Blue Heron, November.

During fall 1974, 4900 casualties were recorded at the new 1000-foot Barrie, Ont. tower. This is greater than the total losses recorded during 1960-73 at the old, 700-foot tower. The first kil' was on 11 August, and the largest single-day kill total, 1523 birds, came on 21 September. The seasonal losses included 1000 Bay-breasted Warblers and 900 Ovenbirds (Devitt 1967).

338. _____. 1975. Casualties at the CKVR TV tower, Barrie. Nat. Can. 4(2):39-40.

During August and September 1974, 4900 dead birds were collected at the newly constructed, 1000-foot tower in Ontario. Large kills occurred in September on the 10th (409 birds), 13th (704), 14th (371), and 21st (1523). Among the casualties were 1000 Bay-breasted Warblers and 900 Ovenbirds. Other species with high losses were the Northern Parula Warbler, Northern Waterthrush, Cape May Warbler, Philadelphia Vireo, and Rose-breasted Grosbeak.

339. Houston, C. S. 1972a. The fall migration: northern Great Plains. Am. Birds 26(1):78-80.

A "modest TV tower kill" at Regina, Sask. on 20 September 1971 is mentioned, but no details are given.

340. _____. 1972b. The spring migration: northern Great Plains. Am. Birds 26(4):774-777.

Kills at the Omega tower, LaMoure, N. Dak. are mentioned (Avery et al. 1975).

341. Houston, C. S., and M. I. Houston. 1975. The fall migration: northern Great Plains. Am. Birds 29(1):74-77.

A tower kill at Regina, Sask. on 11-12 September 1974 included 65 birds of 13 species.

342. Howard, W. I. 1963. Migration versus progress. Bull. Chemung Valley Audubon Soc. 16(1):2.

The new 843-foot WSYE-TV tower, three times taller than the previous tower, was completed in September 1963 at Elmira, N.Y. From 29 September through 4 October, over 200 birds of 36 species, mostly warblers, and one bat were found dead at the tower. Casualties at the old tower were considerably less.

343. [_____.] 1966a. TV tower kill - 1966. Bull. Chemung Valley Audubon Soc. 19(1):1.

During fall 1966, about 260 birds of 33 species, including over 200 on the cloudy night of 19-20 September, were found dead at the WSYE-TV tower, Elmira, N.Y. Total losses of 430 and 125 were recorded in the fall season of 1964 and 1965, respectively.

344. [_____.] 1966b. Two weeks with a Parula Warbler. Bull. Chemung Valley Audubon Soc. 19(1):1-2.

A Northern Parula Warbler injured at the WSYE-TV tower, Elmira, N.Y. was nursed back to health and released.

345. [_____.] 1967. Tower kill 1967. Bull. Chemung Valley Audubon Soc. 20(1):2.

Only 45 birds of at least 17 species were found dead during fall 1967 at the WSYE-TV tower, Elmira, N.Y. Predators no doubt removed other carcasses before they were collected.

346. [_____.] 1968. Tower kill 1968. Bull. Chemung Valley Audubon Soc. 21:2.

About 260 birds of at least 30 species, mostly warblers, were found dead during fall 1968 at the WSYE-TV tower, Elmira, N.Y. About 200 birds died on the night of 25-26 September.

347. [_____.] 1969. Migration casualties - 1969. Bull. Chemung Valley Audubon Soc. 22:3.

The fall 1969 casualties at the WSYE-TV tower, Elmira, N.Y. totalled over 300 birds of 44 species.

348. [_____.] 1970. 1970 tower kill. Bull. Chemung Valley Audubon Soc. 23:1.

During fall 1970, 220 birds of 37 species were killed at the WSYE-TV tower, Elmira, N.Y. Sixty birds died on the late date of 14 October.

349. [_____.] 1971. Tower kill - 1971. Bull. Chemung Valley Audubon Soc. 24:1.

A record number of casualties - 454 birds of 46 species, including 2 bats - was found at the WSYE-TV tower, Elmira, N.Y. during fall 1971. Over 225 birds died on the night of 29-30 September.

350. _____. 1972. Tower kill - 1972. Bull. Chemung Valley Audubon Soc. 25:1-2.

Casualties at the WSYE-TV tower, Elmira, N.Y. totalled 138 birds of 30 species during fall 1972.

351. [_____.] 1973. WSYE-TV casualties - 1973. Bull. Chemung Valley Audubon Soc. 26.

A record total of 465 birds of 39 species, mostly warblers, was found dead at the WSYE-TV tower, Elmira, N.Y. during 27-29 September 1973. Prior to this date, fewer than 100 casualties had been recorded in the month.

352. _____. 1974. Tower casualties. 1974. Bull. Chemung Valley Audubon Soc. 27:4.

The highest total ever - about 1200 birds of 45 species - was recovered at the WSYE-TV tower, Elmira, N.Y. during the fall. On the night of 21-22 September, approximately 844 birds, including 246 Bay-breasted Warblers, were found dead (Kibbe 1975).

353. _____. 1977. Tower kill - 1977. Bull. Chemung Valley Audubon Soc. 30:2-3.

Overcast skies and northerly winds contributed to kills of 1817 (39 species), 1358, 375, 132, and 180 birds on the nights of 19-20 through 23-24 September, respectively, at the WSYE-TV tower in Elmira, N.Y. The total fall losses were 3874 birds (48 species) including 1227 Bay-breasted Warblers. Great Horned Owls and crows probably took numerous injured birds.

354. Howell, A. H. 1932. Florida Bird Life. Fla. Dep. Game Fresh Water Fish and U.S. Bur. Biol. Surv. 479 pp.

The following records of Bachman's Warblers killed at the Sombrero Key, Fla. lighthouse are included: several in March and April 1887 (Merriam 1887), 21 on 3 March 1889, and five on 3 April 1889.

355. Howell, J. C. 1955. A comparison of ceilometer mortality at Knoxville and Nashville, Tennessee, in 1951 and 1954. Migrant 26(4):53-57.

From a comparison of the 15 most abundant species killed in October at these two locations, the author concludes that different migrant populations pass through the two areas. Field counts and kill totals were not in close agreement due to differences in conspicuousness among the species. (See Howell and Tanner 1951, Laskey 1951 and 1954, and Tanner 1954 for kill details.)

356. Howell, J. C., A. R. Laskey, and J. T. Tanner. 1954. Bird mortality at airport ceilometers. Wilson Bull. 66(3):207-215.

This article summarizes 12 kills during 1948-52 and discusses causes of the phenomenon. Observations of bird behavior in ceilometer beams and the influences of weather on mortality are presented.

357. Howell, J. C., and J. T. Tanner. 1951. An accident to migratory birds at the Knoxville airport. Migrant 22(4):61-62.

On the night of 7-8 October, 1044 birds of 46 species were killed at the Knoxville, Tenn. airport ceilometer. The night was overcast with northerly wind.

358. Hunt, R. A. 1972. Some field and court case experiences with waterfowl and electrical powerlines. Proc. 34th Ann. Midwest Fish Wildl. Conf. 34:60.

More research is needed to assess the effects on waterfowl and other wildlife of power lines in and near wetlands. (Abstr.)

359. Hussell, D. J. T. 1965. Long Point Bird Observatory- 1962 and 1963 reports. Ont. Bird Banding 1(1):1-44.

Annual kills at the Long Point lighthouse in 1962 (2500 birds, 52 species) and 1963 (923 birds, 69 species) are mentioned.

360. _____. 1969. Weight loss of birds during nocturnal migration. Auk 86(1):75-83.

In this study, Veeries and Ovenbirds killed at the Long Point lighthouse in May 1965 and September 1966, respectively, are analyzed.

361. Hussell, D. J. T., D. H. Baldwin, W. A. Martin, R. D. Montgomerie, and P. S. Woodford. 1966. Long Point Observatory: 1964 report. Ont. Bird Banding 2(2):1-50.

There was an absence of large kills: 159 birds of 32 species during spring and 113 of 34 species in the fall. A kill on 12-13 April was composed entirely of fringillids.

362. Hussell, D. J. T., W. A. Martin, R. W. Stamp, and P. S. Woodford. 1967. Long Point Bird Observatory: 1965 report. Ont. Bird Banding 3(2):30-78.

The spring kill was relatively light (174 birds, 42 species) and no large single kills occurred in the fall (326 total losses).

363. Idaho Wildlife Cooperative Research Unit. 1976. Semi-annual report. 29(2):27.

One foster-parented Whooping Crane died by striking a barbed-wire fence in Colorado.

364. _____. 1977. Semi-annual report. 30(2):12.

The death in Colorado of one foster-parented Whooping Crane by colliding with a barbed-wire fence is reported. Death by collision appears to be a major cause of mortality among foster-parent reared Whooping Cranes.

365. Imber, M. J. 1975. Behavior of petrels in relation to the moon and artificial lights. Notornis 22(4):302-306.

The author discusses the frequently reported phenomenon of recently fledged petrels being attracted to artifical lights. Adult birds reportedly do not exhibit this behavior. The reactions of young birds to artificial light may be related to food preferences of petrels for bioluminescent organisms (Bourne 1976).

366. Imhoff, T. A. 1954. Bird mortality at Birmingham ceilometer. Ala. Bird-life 2(3&4):38-39.

On 8 October, an estimated 1600 birds (36 species) were killed. A casualty list is given.

367. _____. 1968. Spring migration: central southern region. Audubon Field Notes 22(4): 533-535, 543-544.

Tower kills at Huttig, Ark. (no details) and Birmingham, Ala. (36 birds compared to 60 casualties in fall 1967) are mentioned.

368. Jaago, M. 1970. Accident involving migrant birds at Marjamaa [in Estonian]. Eesti Loodus 1970:184.

Ducks were killed by power lines. This article was not seen; the citation is from Zool. Rec., Aves, 1970.

369. Jackson, W. B., E. J. Rybak, and S. H. Vessey. 1974. Vertical barriers to bird migration. Pages 279-287 in S. A. Gauthreaux, Jr., ed. Proc. Conf. Biol. Aspects Bird/Aircraft Collision Problem. Clemson University.

This paper contains essentially the same information as in Rybak et al. (1973). Kills were also reported at a cooling tower at the new nuclear generating plant at Monroe, Mich. The advent of massive cooling towers at such plants presents new hazards to migrating birds.

370. Jackson, W. B., M. Temme, and W. A. Peterman. 1977. Davis-Besse bird hazard monitoring contract. January:1-21.

At this site near Port Clinton, Ohio, bird losses recorded during 1 September - 22 October 1976 totalled 207 birds (35 species), mostly warblers (57%), kinglets (26%) and finches (3%). As in previous seasons, the cooling tower accounted for most of the losses (88%). The analyses of synoptic weather patterns relative to migrant mortality yield the following generalizations. In the spring, high mortality most likely occurs with a cold front advancing from the west or northwest of Lake Erie, frequently associated with thundershowers and gusting wind. Moderate mortality is expected under overcast conditions accompanying warm fronts and post-frontal lows. In the fall, high mortality occurs almost exclusively with advancing high pressure systems; that is, the first and second evenings following a cold front passage are the most likely for high losses. The weather is usually clear with frequent strong winds. During the pre-operational period at this site, losses of carcasses to scavengers may have reduced the number of recovered mortalities by 50%. Less than one percent of the losses have been non-passerines. Resident birds are seldom involved. Relative to the total migrant volume, losses are minute at the site. Studies elsewhere suggest that diffuse red, orange or blue lights may decrease mortality at stacks and cooling towers. Losses are listed by species for fall 1976, and by family for falls 1975 and 1976. A summary by family and structure of losses during the migration seasons 1972-76 is also given. Weather data and the locations of carcasses at the site are included (Williams and Jackson 1974).

371. _____. 1978. Davis-Besse bird hazard monitoring contract. Ann. Rep. January:1-21.

Mortality at the Davis-Besse nuclear power plant in 1977 totalled 48 (21 species) in the spring and 151 (25 species) plus three bats in the fall. Warblers (31%), vireos (18%), and finches (10%) comprised the bulk of the spring kill, and warblers (65%), kinglets (11%), and finches (5%) dominated in the fall. Greatest losses in both seasons were related to weather patterns previously identified as having high mortality potential (Jackson et al. 1977). Species kill lists for both seasons are given as are summaries by family for spring 1975-77 and fall 1976-77. Results of autopsies on casualties, weather data, and locations of recovered casualties are included.

372. James, D. 1966. Fall migration: central southern region. Audubon Field Notes 20(1):55-61.

Kills at towers at Nashville, Tenn. and Baton Rouge, La. in fall 1965 are mentioned.

373. _____. 1968. Fall migration: central southern region. Audubon Field Notes 22(1):50-54.

The TV tower kill at Nashville, Tenn. during fall 1967 was the lowest in years (Laskey 1968).

374. James, D., and H. H. Shugart, Jr. 1967. Fall migration: central southern region. Audubon Field Notes 21(1):45-47.

The comparatively low fall 1966 kill at the Nashville, Tenn. towers was attributed to mild weather (Laskey 1966).

375. James, P. 1956. Destruction of warblers on Padre Island, Texas in May, 1951. Wilson Bull. 68(3):224-227.

Following the rainy, stormy night of 6 May 1951, 2421 birds of 39 species (mostly warblers) were picked up beneath light poles on this coastal island.

376. Janssen, R. B. 1963. Destruction of birdlife in Minnesota- Sept. 1963. I. Birds killed at the Lewisville television tower. Flicker 35(4):110-111.

On the nights of 18-19 September, 924 birds of 47 species were killed at the 1116-foot KEYC-TV tower. The nights were cloudy with drizzle. A list of the casualties is given.

377. Jarvis, M. J. F. 1974. High tension power lines as a hazard to large birds. Ostrich 45:262.

In South Africa, a European Stork struck a power line, and 30 Cape Vultures were electrocuted on a power line over a 10-year period. The vultures perched on pylons and were killed as they wiped their beaks on the wire.

378. Jennings, A. R. 1960. The major causes of death of wild birds in Great Britain. Pages 353-357 in Proc. 12th Int. Ornithol. Cong., Vol. 1.

Trauma (collisions with obstacles and shooting) accounted for 29% of 800 bird deaths analyzed. This was the largest single cause of death.

379. _____. 1961. An analysis of 1,000 deaths in wild birds. Bird Study 8(1):25-31.

Traumatic injury (shooting and collisions) accounted for 327 of the deaths.

380. Jewett, S. G., W. P. Taylor, W. T. Shaw, and J. W. Aldrich. 1953. Birds of Washington State. Univ. of Washington Press, Seattle. 767 pp.

Several reports of shearwater and storm-petrel mortality at lighthouses are mentioned. At Destruction Island, 149 Beal Petrels (Leach's Storm-petrels) were killed at the light during 31 March - 3 August 1916 (Lien 1923). Lights are particularly hazardous during foggy weather.

381. Johansen, H., and A. Bjerring. 1955. The population of the Stork (Ciconia ciconia (L.)) in Denmark 1952-1954 [in Danish, English summary]. Dan. Ornithol. Foren. Tidsskr. 49:114-126.

Collisions with overhead wires accounted for 35% of the reported deaths of banded Storks. (From English summary)

382. Johansen, K. 1975. Review and analysis of bird impingement and stack illumination at Ontario Hydro generating stations. Rep. 75073. 42 pp.

This report compares the effects on bird losses of various lighting schemes and weather conditions at the Nanticoke and Lennox generating stations. The author concludes that there was no significant correlation between bird kills and weather conditions or between kills and stack illumination modes. Instead, it is felt that factors such as bird migration volume and general site illumination may be of more fundamental importance. At Nanticoke, the 1970-74 kill total was 491 in the spring and 17,207 in the fall. The Lennox plant was completed in fall 1972, and through 1974, the total spring kill was 336, compared to 7211 fall casualties. Also included are kill totals from three other, less destructive generating stations.

383. Johnson, R. E., and G. E. Hudson. 1976. Bird mortality at a glassed-in walkway in Washington State. Western Birds 7(3):99-107.

During May 1968- June 1974, 266 birds of 41 species were collected at this 21.8 m long x 15.3 m high glassed-in walkway at Washington State University, Pullman, Wash. Many species, especially finches, not usually found in other kills were collected here, probably because this structure sampled diurnal migrants and local residents instead of nocturnal migrants. Fringillids accounted for 48.9% of the total kill. Silhouettes of raptors were pasted on the windows in 1970 and mortality was reduced to about one-third of the previous rate.

384. Johnston, D. W. 1955. Mass bird mortality in Georgia, October, 1954. Oriole 20(2): 17-26.

Details of seven incidents in Georgia during 6-8 October 1954 are presented. The largest kill occurred at the Warner Robins Air Force Base ceilometer near Macon, Ga. where an estimated 50,000 birds died. A widespread cold front was associated with these incidents.

385. _____. 1957. Bird mortality in Georgia, 1957. Oriole 22(4):33-39.

Fall bird losses totalling 4189 (78 species) are listed from several towers, two ceilometers and one lighthouse in Georgia and South Carolina. Most of the losses occurred on the night of 4-5 October when rain and cloudy weather prevailed.

386. _____. 1970. Age and sex distribution in Indigo Buntings. Bird-Banding 41(2):113-118.

Data from tower and ceilometer kills are analyzed; males outnumbered females which corroborates findings of other investigators of this species.

387. _____. 1974. Decline of DDT residues in migratory songbirds. Science 186(4166):841-842.

Analyses of 10 species of migratory songbirds killed flying into towers in Florida showed a progressive decline in concentration of DDT and its metabolites for the period 1964-73.

388. _____. 1976. Races of Palm Warblers killed at a Florida TV tower. Fla. Field Nat. 4:22-24.

A total of 369 spring and fall casualties were examined and it was confirmed that the western race of this species is the most common in Florida.

389. Johnston, D. W., and T. P. Haines. 1957. Analysis of mass bird mortality in October, 1954. Auk 74(4):447-458.

During 5-8 October, coinciding with an advancing cold front, 25 instances of mortality totalling over 100,000 birds (88 species) were reported from ceilometers, towers, and buildings in the eastern U.S. The most commonly killed species were the Ovenbird, Magnolia Warbler, Red-eyed Vireo, and Chestnut-sided Warbler. Sex and age composition, weight, fat content and subspecific composition are analyzed in 2552 birds killed on 7-8 October at a ceilometer near Macon, Ga. where an estimated total of 50,000 birds (53 species) died. (See Howell 1955, Johnston 1955, Laskey 1954, and Tanner 1954 for details of the incidents.)

390. Jones, B. 1974. Delta trumpeters. Proc. Pap. Trumpeter Swan Soc. Conf. 3:50-51.

In 1972, one Trumpeter Swan at the Delta, Manitoba Waterfowl Research Station flew into a telephone line.

391. Jones, R. D., Jr. 1976. Monthly activity report, Izembek National Wildlife Refuge. 4 November.

Amidst a severe snow squall on 26 October, about 150 Brant and Emperor Geese were killed when they flew into a cannery building and the rigging of moored fishing vessels at King Cove, Alaska. The birds were apparently attracted to and blinded by lights in the area.

392. Judd, P. L. 1910. News notes. Oologist 27(4):51.

Snipe were killed by flying into wires.

393. Kale, H. W., II. 1970. The spring migration: Florida region. Audubon Field Notes 24(4):591-595.

The only large kill of the season at the WCTV tower near Tallahassee occurred on 1 April when 32 birds of 14 species were killed.

394. _____. 1971a. The spring migration: Florida region. Am. Birds 25(4):723-725, 730-735.

Kills, mostly of warblers, in late April and early May, are mentioned from five towers, a hotel, a shopping center, and the Merritt Island Vehicle Assembly Building on Cape Kennedy (2500 birds, 42 species).

395. _____. 1971b. Report on bird kill at construction site of Florida Power and Light Company's Hutchinson Island nuclear energy power plant, night of April 26-27, 1971. Unpubl. rep. 3 pp.

Low clouds and bright floodlights resulted in the death of at least 282 birds of 20 species from collisions with a crane tower and its guy wires. A kill list is given with species sex ratios.

396. _____. 1972. The spring migration: Florida region. Am. Birds 26(4):751-754.

Only 35 warblers were killed at the WDBO-TV tower in Orlando, and just one bird, a Red-breasted Merganser, was found at the WCTV tower near Tallahassee. Fewer birds were killed at the Vehicle Assembly Building at Cape Kennedy than during the previous spring.

397. _____. 1973. The spring migration: Florida region. Am. Birds 27(4):761-765.

Thirty casualties were reported from WCTV on 26 April and about 300 birds died at the Vehicle Assembly Building at Cape Kennedy on 10-11 May.

398. _____. 1975. The spring migration: Florida region. Am. Birds 29(4):839-843.

Migration records from the WCTV tower are mentioned.

399. _____. 1976. The spring migration: Florida region. Am. Birds 30(4):828-832.

Migration records from the WCTV tower are mentioned.

400. _____. 1977. The spring migration: Florida region. Am. Birds 31(5):988-992.

A migration record from the WCTV tower near Tallahassee is mentioned.

401. Kale H. W., II, M. H. Hundley, and J. A. Tucker. 1969. Tower-killed specimens and observations of migrant birds from Grand Bahama Island. Wilson Bull. 81(3):258-263.

On the night of 21-22 October 1966, 136 birds of 22 species were killed at two small towers (200 and 400 feet). About half of the kill consisted of Gray-cheeked Thrushes and Blackpoll Warblers. Weather conditions are discussed.

402. Karlsson, J. 1977. Bird collisions with towers and other man-made constructions [in Swedish, English summary]. Anser 16:203-216.

The article briefly reviews the problem of bird strikes at towers, lighthouses, power lines, and other structures. Data on bird kills at Swedish towers were obtained through questionnaires. Results showed that birds were rarely disturbed by towers less than 250 m in height, but some taller towers reported frequent mortality. A list of 23 species from kills at eight towers is given. Regulus regulus and various species of thrushes (Turdus sp.) appeared most frequently in the kill lists. (From English summary.)

403. Keil, W. 1964. Der Glaserne Tod. Vogel-Kosmos 8:184-186.

Pasting cut-out silhouettes of raptors helped reduce bird strikes at windows in Europe, where hundreds of thousands of birds die annually due to window strikes.

404. Kemper, C. A. 1958a. Destruction at the TV tower. Passenger Pigeon 20(1):3-9.

In fall 1957, three large kills, including one of an estimated 20,000 birds (based on 1525 of 40 species actually collected), were reported from the 1000-foot Eau Claire, Wis. TV tower. Warblers dominated the kill lists.

405. _____. 1958b. Bird destruction at a TV tower. Audubon Mag. 60(6):270-271, 290-293.

This is the same article as Kemper 1958a.

406. _____. 1959. More TV tower destruction. Passenger Pigeon 21(4):135-142.

The tower at Eau Claire, Wis. produced only light kills in 1958 and 300 deaths in spring 1959. Over 2500 birds of 65 species were killed in fall 1959. The author lists the 1959 kills and discusses weather conditions during the five major kills in 1957 and 1959. He also presents a theory explaining massive tower kills involving the birds' supposed ability to detect geomagnetic lines of force.

407. _____. 1964. A tower for TV, 30,000 dead birds. Audubon Mag. 66(2):86-90.

An estimated 30,000 birds were killed at the Eau Claire, Wis. tower on the nights of 18-19 and 19-20 September 1963. Lists of the 10,195 birds of 56 species actually collected there, and of 924 birds (47 species) killed on 20-21 September at Lewisville, Minn. (Janssen 1963) are given. To explain the mass mortality of birds at towers, a theory is proposed in which migrants attempt to maintain a constant bearing with respect to the red tower lights (thinking them to be stars) and thereby spiral closer and closer to the structure, eventually striking guy wires.

408. Kemper, C. A., D. G. Raveling, and D. W. Warner. 1966. A comparison of the species composition of two TV tower killed samples from the same night of migration. Wilson Bull. 78(1):26-30.

Kills at towers in Eau Claire, Wis. and Westport, Minn. during the night of 9-10 September 1962 are compared. The Wisconsin kill was composed of typically woodland species, but the Minnesota kill contained more prairie edge species and lacked many of the woodland species reported at kills farther east. (See Avery and Clement 1972 for similar findings in North Dakota.)

409. Kemper, C. A., S. D. Robbins, and A. C. Epple. 1964. The ornithological flood of September 18-20, 1963. Passenger Pigeon 26(4):159-172.

This is a detailed account of a very heavy migration through Minnesota and Wisconsin. Included are "chip" counts, daytime field counts, banding data, and tower kill results from Eau Claire, Wis. and Lewisville, Minn. (Kemper 1964).

410. Kibbe, D. P. 1975. The fall migration: western New York and northwestern Pennsylvania. Am. Birds 29(1):53-57.

Throughout fall 1974, over 1200 birds of 44 species were killed at the Elmira, N.Y. TV tower including the largest kill ever (844 birds, 35 species) on the cloudy night of 21-22 September (Howard 1974).

411. _____. 1976. The fall migration: Niagara-Champlain region. Am. Birds 30(1):64-66.

Over 800 birds of 40 species were collected at the Elmira, N.Y. tower on 19 September 1975 following a night of low overcast. Included were 198 Bay-breasted Warblers, 110 Magnolia Warblers, and 78 Ovenbirds. A kill at an Erie County, N.Y. tower on 8 September included five Pine Warblers.

412. Kiel, D. W., and J. F. Cassel. [1978.] Avian mortality study at Underwood, ND, fall report. Zool. Dep., North Dakota State Univ., Unpub. rep. 4 pp.

From 13 September through 10 November 1977, 15 birds of 9 species were found dead beneath a Bureau of Reclamation power line in central North Dakota.

413. Kingery, H. E. 1971. The spring migration: Great Basin-central Rocky Mountain region. Am. Birds 25(4):774-780.

In Wyoming and Colorado, over 78 Bald and Golden Eagles were electrocuted at power lines in spring 1971.

414. Kleen, V. M. 1974. The fall migration: middlewestern prairie region. Am. Birds 28(1):58-63.

"Only a few TV tower casualties were reported" in 1973.

415. _____. 1975. The fall migration: middlewestern prairie region. Am. Birds 29(1):64-68.

Over 1500 birds (about 50% Red-eyed Vireos) were killed at a tower near Des Moines, Iowa on the nights of 11 and 12 September 1974. Lesser kills were reported from Cape Girardeau, Mo. and Springfield, Ill.

416. _____. 1978. Field notes, fall migration. Ill. Audubon Bull. 184:40-51.

At the Olney, Ill. tower, 400 birds of 51 species were found dead from 29 August to 6 December 1977.

417. Kleen, V. M., and L. Bush. 1973. The fall migration: middlewestern prairie region. Am. Birds 27(1):66-70.

During the night of 1-2 September 1972, tower kills occurred at Springfield (735 birds, 35 species) and Charleston (137 birds), Ill.

418. Kleiber, (Mrs.) C. E. 1968. Tinklebells warn birds. Chat 32(1):9.

In South Carolina, small wind bells hung above a glass door eliminated bird strikes.

419. Klem, D., Jr. 1979. Biology of collisions between birds and glass. Ph.D. Thesis. Southern Illinois Univ., Carbondale. (From abstract supplied by author.)

This study attempted to determine: (1) the species of birds that most often fly into windows in the U.S. and Canada, (2) the injuries incurred and the differential season, age, and sex mortality resulting from the phenomenon, (3) the prevailing weather conditions at the time of collisions, (4) the properties and types of glass and man-made structures at which collisions occur, (5) the ability of birds to distinguish real habitat seen through or reflected in glass, and (6) the facultative ways of reducing the frequency of collisions. A survey of window-killed specimens and bird-glass collision accounts from the literature and from museums and other collections revealed 215 species belonging to 43 families. Data collected from southern Illinois during 1971-77 included 63 species in 24 families. Systematic monitoring of two homes (Carbondale, Ill. and Purchase, N.Y.) registered 61 and 47 bird-window collisions in one year, respectively. The combined data indicate that finches, warblers, thrushes, woodpeckers, waxwings, and hummingbirds are most prone to collisions with windows. Mortality involves adults and juveniles, males and females, and occurs under almost all weather conditions at reflective and plate glass surfaces varying in size, height from ground, and type of structure. An estimated minimum of 80 million birds die annually in the U.S. from striking glass structures. Laboratory and field experiments indicate that birds are unable to detect or avoid glass. Alternative measures to prevent birds from colliding with glass are suggested and discussed as to their practical application.

420. Knauth, O. 1972. Hundreds of birds die after hitting TV tower. Des Moines Sunday Register, 24 September:1,3.

On the night of 7-8 September, 726 birds, including 406 warblers of 22 species, were killed at a 2000-foot TV tower at Alleman, Iowa. The kill followed the passage of a cold front through the area. A kill of 226 birds (46 species) on 11-12 May is mentioned.

421. Kochert, M. N. 1972. Population status and chemical contamination in Golden Eagles in southwestern Idaho. M. S. Thesis. Univ. of Idaho, Moscow. 115 pp.

Electrocution was the major cause of death among juvenile eagles. Overall, impact injuries and electrocution accounted for 27% and 16% of the recorded deaths, respectively.

422. Koford, C. B. 1953. The California Condor. Natl. Audubon Soc. Res. Rep. No. 4. 154 pp.

A California Condor broke its humerus and died near Fillmore, Calif. in 1941 after apparently colliding with a slender vertical pipe that had been used as a surveying marker.

423. Konig, C. 1963. Glaswande als Gefahren fur die Vogelwelt. Inter. Rat fur Vogelschutz, Bericht 2:53-55.

Birds are frequently killed at windows and glass corridors, especially on misty days or during migration. Making glass more visible helps reduce losses. This is done by using translucent or sand-blasted glass, pasting silhouettes onto glass surfaces, planting bushes or trees in front of windows, or hanging draperies or curtains in the windows. (From translation supplied by Daniel Klem, Jr.)

424. Kramer, Q. 1949. Bird tragedy in a fog. Cassinia 37:21-22.

On the night of 10-11 September 1948, many migrants were killed at tall structures and ceilometers in New York, Philadelphia, Baltimore, Washington and Nashville. A list of 207 birds of 23 species from Philadelphia is given (Aronoff 1949 and Spofford 1949a, b).

425. Krapu, G. L. 1974. Avian mortality from collisions with overhead wires in North Dakota. Prairie Nat. 6(1):1-6.

This is a review of the problem in North Dakota. Personal observations of the author and other experienced field researchers are related, and incidents from the literature are cited. The increased construction of power plants and associated transmission lines may pose a significant hazard to birdlife in the state.

426. Krause, H. 1960. Fall migration: northern Great Plains region. Audubon Field Notes 14(1):47-50.

On 22 September 1959, 33 birds of 13 species, mostly Yellow-rumped and Orange-crowned Warblers, were killed at the Moose Jaw, Sask. TV tower (Lahrman 1959).

427. Kretzschmar, H. 1969. Grosstrappen fliegen gegen Hochspannungsleitung. Falke 16:94-95.

Several instances of Great Bustards, Otis tarda, striking power lines are reported.

428. _____. 1970. Wiederum: Grosstrappe gegen Starkstromleitung. Falke 17:283.

Another Great Bustard was killed by striking a power line.

429. Kumlien, L. 1888. Observations on bird migration in Milwaukee. Auk 5(3):325-328.

The author describes mortality and behavior of migrants at a building having a tower 200 feet above street level and illuminated by four floodlights nightly until 2300 or 2330. During 22-29 September 1887, many birds struck the building and nearby electric wires; "a market-basket full of birds" was collected on the night of 24-25 September. Differences in the reactions of various types of birds to the structure were noted. Several times shorebirds were heard near the tower and though some passed close to the lights, they did not stay long. Thrushes were seen often, "but never going very close, nor flying directly at the lights as most of the Warblers did." Rails and gallinules were heard flying past very low, not attracted to the tower. Night herons "did not seem attracted by the lights" and flew well above the tower. Almost all of the birds observed "had a peculiar dragging flight like a bird wounded through the intestines." This flight behavior was compared to that of the male Yellow-breasted Chat during displays in the breeding season: "wings raised high, tail dropped low and head raised, so that the body . . . is at a considerable slope." The author concludes that in this way, "it is probable the birds are better able to sustain continued flight by flying in this manner with the wind." (This article and Clarke's 1912 are among the few that provide detailed descriptions of the behavior of birds at tall, lighted structures.)

430. Laband, K. A. 1951. An accident to birds at the ceilometer near Smyrna. Migrant 22(4):63.

An estimated 1000 birds of 11 species died during the night of 7-8 October 1951 at the Stewart Air Force Base ceilometer in Tennessee.

431. Lahrman, F. W. 1959. TV tower casualty list. Blue Jay 17(4):142-143.

A list is given of the casualties (33 birds, 13 species) during September at the 480-foot Moose Jaw, Sask. TV tower.

432. _____. 1962. Fall migration TV tower kills, 1962. Blue Jay 20(4):152.

TV towers in Regina, Moose Jaw, and Caron, Sask. accounted for losses totalling 86 birds of 26 species. A kill list is included.

433. _____. 1965. Regina and Lumsden TV tower bird mortalities, 1964. Blue Jay 23(1):18-19.

In Saskatchewan, six visits to two Regina and one Lumsden tower during 20 August-4 September resulted in the collection of over 500 dead birds of 34 species. Kill lists are given.

434. Langridge, H. P. 1960. Warbler kill in the Palm Beaches. Fla. Nat. 33(4):226-227.

During 9-14 May, 127 birds of 7 species, including 98 Common Yellowthroats, were found dead, presumably killed by striking store windows.

435. Lano, A. 1927. Great Blue Heron (Ardea herodias) electrocuted. Auk 44(2):246.

A male of this species was found dead beneath several high power electric light wires in Arkansas on 30 October 1926. Burn marks indicated that it had struck the wires and been electrocuted.

436. Laskey, A. R. 1951. Another disaster to migrating birds at the Nashville airport. Migrant 22(4):57-60.

On the night of 7-8 October, 476 birds of 40 species died at a ceilometer. The sky was overcast with northerly winds. A kill list is given and the role of winds in the mass mortality is discussed.

437. _____. 1954. Bird mortality- Nashville and Smyrna. Migrant 25(4):59-61.

In Tennessee, on the night of 6-7 October, kills occurred at ceilometers in Nashville (255 birds, 21 species) and Smyrna (600 birds). A cold front had passed through the area earlier in the day. On another occasion, birds circling in the ceilometer beam departed as the low cloud ceiling lifted.

438. _____. 1956a. Bird casualties at Smyrna and Nashville ceilometers, 1955. Migrant 27(1):9-10.

Over 1400 birds of 51 species were killed or injured on the night of 24-25 September, mostly at Smyrna, Tenn. A kill list is given.

439. _____. 1956b. Television towers and nocturnal bird migration. Migrant 27(4):66-67.

During 5-19 October, 68 birds of 27 species were found at Nashville towers. A kill list is provided.

440. _____. 1957. Television tower casualties, Nashville. Migrant 28(4):54-56.

Daily searches during 23 September - 15 November at a 1000-foot TV tower resulted in the collection of 704 dead birds of 67 species. Cold fronts with overcast and north winds accompanied the peak kill dates. A list of the casualties is given. A 878-foot tower with fewer guy wires, and an unsupported TV tower produced only a few dead birds.

441. _____. 1960. Bird migration casualties and weather conditions, autumns 1958-1959-1960. Migrant 31(4):61-65.

At Nashville's WSIX tower (940 feet tall), kill totals for the three seasons were 223 (55 species), 562 (59), and 1553 (65), respectively. The new 1369-foot WSM tower, seven miles NNW of WSIX, produced 2130 casualties (59 species) during fall 1960 (Ogden 1960). Descriptions of the towers, weather conditions, and kill lists are given. The ceilometer at the Nashville airport, equipped with a filter permitting only ultraviolet light to pass through, produced no known deaths. (See Terres 1956a and Velie 1963 for more on ceilometer filters.)

442. _____. 1962. Migration data from television tower casualties at Nashville. Migrant 33(1):7-8.

Daily searches at the WSIX tower in fall 1961 resulted in 228 birds of 52 species recovered. One collection at WSM totalled 183 birds of 27 species. Kill lists are provided.

443. _____. 1963a. Casualties at WSIX TV tower in autumn 1962. Migrant 34(1):15.

Daily searches during 6 September - 11 November yielded 243 dead birds of 43 species at the tower. A species list is given.

444. _____. 1963b. Mortality of night migrants at Nashville TV towers, 1963. Migrant 34(4):65-66.

A total of 630 birds of 62 species was found on daily visits to three towers in fall 1963. Two kills occurred on clear nights.

445. _____. 1964. Data from the Nashville T.V. tower casualties, autumn 1964. Migrant 35(4):95-96.

Kill totals at WSM and WSIX were 1275 (61 species) and 665 (58 species), respectively. The higher total from WSM may be due to its proximity to the city's bright lights and their attractive effect on migrants. Species lists of the kills are provided.

446. _____. 1965. Autumn 1965 TV tower casualties at Nashville. Migrant 36(4):80-81.

Spring casualties amounted to 24 total dead birds of 13 species. In the fall, 681 birds of 51 species were found at WSM and 176 of 41 species at WSIX. Kill lists are given.

447. _____. 1966. T.V. tower casualties at Nashville; spring and fall, 1966. Migrant 37(4): 61-62.

The largest spring kill to date in Nashville, 37 birds of 12 species, occurred on 26 April at WSM. Only three birds were found at the WSIX tower during the season. Fall casualties totalled 681 (70 species) and 228 (45 species) at WSM and WSIX, respectively. Among the casualties were 9 Mourning Doves and 13 Brown Creepers. Species lists are given.

448. _____. 1967. Spring mortality of Blackpoll Warblers at a Nashville T.V. tower. Migrant 38(2):43.

Of the 160 birds of 12 species killed at the WSM tower on 14-15 May 1967, 115 (72%) were Blackpoll Warblers, an unusually high number of casualties for this species. During the entire spring, 173 birds of 13 species were killed and a list of the casualties is given.

449. _____. 1968. Television tower casualties at Nashville, autumn 1967. Migrant 39(2):25-26.

The fall kill was the lowest to date here: 251 birds of 40 species at WSM and 98 of 27 species at WSIX. Lists of the kills are given.

450. _____. 1969a. T.V. tower casualties at Nashville in autumn 1968. Migrant 40(2):25-27.

Daily coverage of WSM from late August through 8 November yielded 5537 birds of 73 species. Of these, 5408 were killed on the night of 25-26 September; 81% were warblers. The WSIX tower was not checked daily, and only 197 birds (39 species) were collected there.

451. _____. 1969b. Autumn 1969 T.V. tower casualties at Nashville. Migrant 40(4):79-80.

Kill lists are given from WSM (1602 birds, 57 species) and WSIX (307 birds, 51 species).

452. _____. 1971. T.V. tower casualties at Nashville: spring and autumn, 1970. Migrant 42(1):15-16.

Ten birds of nine species were killed at WSM in the spring. Fall losses totalled 3683 birds of 66 species at WSM and 104 of 21 species at WSIX. On the drizzly night of 28 September, 3482 birds (54 species) died at WSM and 78 were killed at WSIX. Warblers dominated the fall losses: 845 Tennessee Warblers, 631 Ovenbirds, 429 Black-and-white Warblers, and 420 Magnolia Warblers.

453. Lee, J. M., Jr. 1977. Transmission lines and their effects on wildlife: a status report of research on the BPA system. Presented at the annual meeting of Oregon chapter of the Wildl. Soc., Kah-Nee-Ta, 19-21 January 1977.

Preliminary observations indicated that avian mortality due to collisions with the transmission lines studied was not significant. Other effects to wildlife are discussed and it is concluded that to date few adverse effects have been found. In addition, the right-of-way " were found to produce increased habitat diversity for both terrestrial and avian species."

454. _____. 1978a. A summary of reports of bird collisions with power and communication lines. Bonneville Power Admin. Unpub. rep.

Nineteen references are cited in a table giving type of line, location, numbers and types of birds involved, and circumstances associated with the losses.

455. _____. 1978b. Effects of transmission lines on bird flights: studies of Bonneville Power Administration lines. Pages 53-68 in M.L. Avery, ed. Impacts of transmission lines on birds in flight. U.S. Fish Wildl. Serv. FWS/OBS-78/48.

This report describes studies currently in progress in Oregon concerning the impacts of high voltage transmission lines on birds in flight. Between 29 January and 28 April 1977, 60 birds, including 29 gulls, were found dead at one site. The total mortality may have been higher but an exact count was impossible due to scavengers removing carcasses, dead birds falling into water, and mortally injured birds leaving the area before dying. In good visibility, field observations on four dates revealed an average of one observed collision for every 3370 observed flights across the spans where the dead birds were found. Eighty-nine percent of the birds seen flew above the conductors. At other sites, 19 dead birds (7 species) were collected between 22 October and 21 December 1977. During this time, eight collisions were observed, an average of 1 per 2233 observed flights. All collisions occurred in good visibility. Included is a table summarizing eight other studies of bird collisions with overhead conductors.

456. Lemmon, W. P. 1898. Virginia Rail killed by striking a telephone wire. Auk 15(1):51.

This occurred at Englewood, N.J. on a clear night.

457. [Lewis, G.] 1970. Television is not for the birds. Topeka Audubon News 24(4).

This is an unsigned, unpaged article by Lewis, the editor, that reviews the tower kills that have occurred in the Topeka, Kansas area. The first reported kill occurred in fall 1954 at the WIBW tower (now KTWU) when over 1000 birds of 68 species died (Tordoff and Mengel 1956). Thereafter, little mortality was recorded until 1967 when, on 2 October, 800 birds of 43 species were killed at a newer, taller tower at Maple Hill (Carson 1967). The most recent kill occurred at the Maple Hill tower in mid-September 1970 when 270 birds of 36 species died on a misty, rainy night. A partial list of casualties is given.

458. Lewis, H. F. 1927. Destruction of birds by lighthouses in the provinces of Ontario and Quebec. Can. Field Nat. 41(3):55-58, 41(4):75-77.

The results of a questionnaire survey of 135 lighthouse keepers (68 replies) on bird mortality are presented. Flashing, white lights were the most destructive type (fixed beacons and red lights caused little problem) although considerable variation existed in the extent of mortality from light to light. No correlation was found between kill and the height of the light, its strength, or the flash rate. Several accounts of bird behavior at lights are given.

459. Lien, C. 1923. Birds killed by lighthouse. Murrelet 4(2):8-10.

Included is a list, by date, of birds killed at the 149-foot Destruction Island lighthouse, 45 miles south of Cape Flattery, Wash., during 1916. Weather notes are given.

460. Lincoln, F. C. 1939. The migration of American birds. Doubleday, Doran and Co., Inc., New York. 189 pp.

Some aspects of the bird mortality at the Washington Monument during 1901-37 are discussed. Losses decreased as the illumination of the city was improved and the monument became more visible at night. However, floodlighting the structure in 1931 seemed to increase losses (Overing 1936). When the torch of the Statue of Liberty was kept lighted, it killed as many as 700 birds per month.

461. _____. 1950. Migration of birds. U.S. Fish Wildl. Serv. Circ. 16. 102 pp.

Included is a general discussion of hazards, particularly monuments, buildings and lighthouses; to nocturnal migrants.

462. Lister, R. 1965. Fall migration: northern Great Plains region. Audubon Field Notes 19(1):48-53.

Mortality and weather at three towers near Regina, Sask. in fall 1964 is discussed in detail (Lahrman 1965).

463. Lohrl, H. 1962. Vogelvernichtung durch moderne Glaswande. Kosmos 58:191-194.

The problem of bird losses at glass corridors and windows is discussed. The use of silhouettes pasted onto the glass surfaces helped reduce losses in some instances. At one site, cats regularly patrolled the area and took the collision casualties. The location of a building largely determines which species are killed. To minimize losses, the author suggests that the potential impact on birds be considered in the planning of structures. Opaque or translucent glass may have less adverse effects than transparent glass. (From translation supplied by Daniel Klem, Jr.)

464. Lord, W. G. 1951. Bird fatalities at Bluff's Lodge on the Blue Ridge Parkway, Wilkes County, N.C. Chat 15(1):15-16.

Over 200 birds of 23 species were killed on the foggy night of 17 September 1950. The birds probably were confused by floodlights and crashed into the lodge. A species list is given.

465. Lovell, H. B. 1952. Catastrophe to birds at a Louisville airport. Ky. Warbler 28(1):5-6.

About 100 birds of at least 13 species were killed at the ceilometer of the Louisville, Ky. airport in early October 1951. A partial species list is given.

466. Lupient, M. 1961. Fall migration: western Great Lakes region. Audubon Field Notes 15(1):42-44.

An estimated 12,000 birds died at towers in the region on the night of 21-22 September 1960. Of these, 1225 (42 species) were collected at Chippewa Falls, Wis. Other kills in western Wisconsin occurred earlier in the month.

467. _____. 1962a. Fall migration: western Great Lakes region. Audubon Field Notes 16(1):34-35.

From 2 September to 10 October 1961, 5097 birds were collected at the Eau Claire, Wis. TV tower. These were estimated to be 10-20% of the actual total kill.

468. _____. 1962b. Spring migration: western Great Lakes region. Audubon Field Notes 16(4): 441-413.

May casualties at a Chippewa Falls, Wis. TV tower totalled 217.

469. _____. 1963. Fall migration: western Great lakes region. Audubon Field Notes 17(1): 34-36.

On the night of 9-10 September 1962, 48 birds were killed at the Duluth, Minn. ceilometer.

470. MacBriar, W. M., Jr. 1959. Bird fatalities at a "tower" in 1887. Passenger Pigeon 21(3):105-106.

The article by Kumlien 1888 is summarized.

471. MacDonald, E. F. 1962. TV towers and migratory birds. Bull. Oshawa Nat. Club 8(4):5-7.

From 9 September to 6 October 1961, 213 birds of 38 species were found dead at the 900-foot CFTO tower in Agincourt, Ont. Daily searches for dead birds were made, and much predation and scavenging of carcasses by crows was noted. Large kills seemed to occur when fog was present. Reference is made to the kill at a Barrie, Ont. tower in 1960 (Westman 1960), and a newspaper report from the Sacramento, Calif. area of birds flying blindly in a fog, causing power outages through collisions with transmission lines and poles, is briefly noted (Anon. 1962b).

472. MacFayden, C. 1970. TV tower bird kills. Blue Heron 15(2).

Late migration dates of 10 species killed at the CKVR-TV tower at Barrie, Ont. are presented.

473. MacIntyre, D. 1946. Damage to bird life. Field 187:19.

Overhead wires cause bird losses. This article was not seen; the citation is from Zool. Rec., Aves, 1946.

474. MacKay, B. K. (undated). Bird kill statistics for Toronto Dominion Centre-Commerce Court complex 1973. Unpubl. rep. 5 pp.

This is a date-by-date listing of the casualaties during spring and fall 1973. Almost daily searches were made through May and early June and from late August through early November.

475. Madsen, H., and K. Storgaard. 1955. Some remarks on birds fallen at a lightvessel in the North Sea. Dan. Ornithol. Foren. Tidsskr. 49:201-205.

Of 317 birds collected at a Danish lightship, 139 died of poor health or depleted fat, not from striking the light.

476. Mahon, B. 1974. Southwest Nebraska trumpeters. Proc. Pap. Trumpeter Swan Soc. Conf. 3:49.

One Trumpeter Swan hit a telephone wire or fence and broke its neck in 1970.

477. Malcolm, J. M. 1974. Turnbull Refuge trumpeters. Proc. Pap. Trumpeter Swan Soc. Conf. 3:15-20.

Of 13 known losses during 1963-72, four swans collided with power lines which are considered to be a significant limiting factor to the population in Washington.

478. Manuwal, D. D. 1963. TV transmitter kills in South Bend, Indiana, fall 1962. Ind. Audubon Q. 41(3):49-53.

Two towers (1074 and 650 feet tall) produced 289 casualties of 46 species during fall 1961 and spring and fall 1962. Species lists by tower and data of collection are given.

479. Markus, M. B. 1972. Mortality of vultures caused by electrocution. Nature 238:228.

High tension power lines in southwest Transvaal killed at least 148 Gyps coprotheres from 1 January 1970 to 31 March 1972.

480. Marshall, W. H. 1940. An "eagle guard" developed in Idaho. Condor 42:166.

A device to discourage eagles and other large raptors from landing on power lines was developed by the Idaho Power Company. By using the guards, interruptions of service due to short circuits caused by birds have been practically eliminated. Short circuits caused by birds are localized problems, and trouble areas shift somewhat from year to year, perhaps corresponding to shifts in the abundance of prey items.

481. Mayfield, H. 1949. Spring migration: middlewestern prairie region. Audubon Field Notes 3(4):210-211.

Four birds were found dead at the base of the 300-foot Perry Monument on South Bass Island in Lake Erie.

482. _____. 1951. Fall migration: middlewestern prairie region. Audubon Field Notes 5(1): 18-22.

During fall 1950, the species composition of the birds found dead at the Perry monument in Lake Erie was quite dissimilar to the composition of field-observed migrants. No details are given.

483. _____. 1967. Shed few tears. Audubon Mag. 69(3):61-65.

Bird mortality is discussed in statistical terms. Tower losses may account for 1 million deaths annually, about 0.016 of 1% of the total estimated yearly mortality. Habitat destruction is cited as the main cause for concern for bird populations.

484. McCarthy, T. 1973. Ocular impalement of a Great Horned Owl. Wilson Bull. 85(4):477-478.

The bird had flown into the top strand of a barbed wire fence near St. Elizabeth, Mo. on 24 July 1972.

485. McCartney, R. B. 1963. The Fulvous Tree Duck in Louisiana. M.S. Thesis. Louisiana State Univ., Baton Rouge. 157 pp.

The life history of the Fulvous Tree Duck (Whistling-Duck) was studied in southwestern Louisiana. Adult birds were frequently killed or crippled by striking power lines. Most of these incidents probably occurred at night.

486. McKenna, M. G., and G. E. Allard. 1976. Avian mortality from wire collisions. N. Dak. Outdoors 39(5):16-18.

Between 31 May and 24 August, 244 dead birds were collected under high voltage power transmission lines beside two bodies of water in central North Dakota. In all, 11 trips were made to the site, and the recorded mortality was probably an underestimate because unknown numbers of carcasses may have been removed by scavengers or may have fallen in inaccessible places. Crippled birds were probably able to swim away undetected. Casualties are listed by date of collection. The American Coot (88), Double-crested Cormorant (52), Pied-billed Grebe (29), and Eared Grebe (26) were the most commonly killed species. In addition, 18 ducks of 7 species were killed. To reduce impacts to birds, it is suggested that power lines be buried or masked by structures such as bridges where they cross natural flyways, and that corridors be established where all lines would be routed.

487. McLaury, E. 1974. Trumpeter Swans - reintroduction and success on the Malheur National Wildlife Refuge. Proc. Pap. Trumpeter Swan Soc. Conf. 3:20-31.

Five of the 60 known deaths during 1939-72 were due to power line collisions. Since 1958, shooting and power lines have been the principal causes of mortality.

488. McMinn, M. 1978. Power line kills of Eared Grebes. Unpubl. rep.

In December 1977 and January 1978, 18 Eared Grebes were picked up at roadsides in the vicinity of Salton Sea National Wildlife Refuge, Niland, Calif. All were found on the side of the road opposite power lines, and except for two that may have been road kills, all seemed to have collided with the overhead wires.

489. Medway, Lord, and I. C. T. Nisbet. 1968. Bird Report:1966. Malayan Nat. J. 21(1):34-50.

In fall 1966, 61 birds (14 species) were killed at two Malaysian lighthouses. Also, a combined list of the birds found dead or netted, ringed and released at the telecoms tower atop Fraser's Hill, Malaysia (4500 feet above sea level) is presented.

490. Medway, Lord, I.C.T. Nisbet, and D. R. Wells. 1968. Bird report:1967. Malayan Nat. J. 21(4):185-200.

A list of birds trapped and banded, or found dead at the Fraser's Hill tower is given with a list of birds killed at three Malaysian lighthouses (143 birds, 17 species) for the period August -December 1967.

491. Medway, Lord, and D. R. Wells. 1970. Bird report:1968. Malayan Nat. J. 23(2):47-77.

Bird losses at three Malaysian lighthouses (82 birds, 17 species) and one tower (16 birds, 8 species) during 1968 are listed.

492. Mercer, B. 1905. A municipal bird trap. Am. Ornithology 5(3):53-55.

About 2,000 birds have been killed at the floodlit statue of William Penn atop the Philadelphia, Pa. city building (549 feet high) since July 1897. Most casualties are young birds, and although thousands of migrants pass close to the lights, relatively few strike them. No strikes occur on moonlit nights. A list of the 60 species killed to date is given. (Baily 1899, 1901.)

493. Meritt, J. K. 1960. An Albany airport ceilometer disaster in 1956. Kingbird 10(4):170-171.

On the rainy night of 15 September, 313 birds of 25 species died at the ceilometer and many others were seen perched on guard rails around the light. A species list is given.

494. Merriam, C. H. 1885a. Preliminary report of the committee on bird migration. Auk 2(1):53-57.

Forms were circulated to 6000 lighthouse keepers on the North American coasts asking for reports of bird kills. Similar circulars sent to 255 stations in South America, Central America, and the West Indies yielded results indicating that many birds were killed annually on both South American coasts and in the West Indies, particularly on the north coast of Cuba.

495. _____. 1885b. Bird migration at Sombrero Key, Florida. Auk 2(1):60-63.

Bird losses at the southernmost U.S. lighthouse are given for 29 April - 25 September 1884. Weather notes and a kill list are provided.

496. _____. 1885c. Bird migration at the Straits of Mackinac. Auk 2(1):64-65.

Large numbers of birds strike this Michigan lighthouse on misty and rainy nights. Some species are listed.

497. _____. 1885d. Kirtland's Warbler from the Straits of Mackinac. Auk 2(4):376.

A male Kirtland's Warbler was killed by striking the lighthouse on Spectacle Reef, Michigan in the western part of Lake Huron near the Straits of Mackinac on the night of 21 May 1885. Other species found dead were Wood Thrush, Blackburnian Warbler, Magnolia Warbler, Ovenbird, Savannah Sparrow, and Least Sandpiper.

498. _____. 1887. Another specimen of Bachman's Warbler (Helminthophila bachmani). Auk 4(3):262.

A Bachman's Warbler was killed after striking the lighthouse at Sombrero Key off southern Florida on the night of 21 March 1887.

499. Miller, D., E. L. Boeker, R. S. Thorsell, and R. R. Olendorff. 1975. Suggested practices for raptor protection on powerlines. Edison Electric Inst. 21 pp.

"The material in this report is an attempt to set forth the state-of-the-art as of June 1975." Included are 16 pages of diagrams showing how utility poles can be modified to reduce the hazard to raptors. In conducting this investigation, it was found that most eagle electrocutions occurred during the winter when the birds were more concentrated, and 98% of the recorded eagle deaths at power lines involved juvenile birds. The report may be obtained from Raptor Research Foundation, Inc., Dep. of Zool., Brigham Young Univ., Provo, Utah, 84601.

500. Miller, G. S., Jr. 1897. Winge on birds at Danish lighthouses. Auk 14(4):415-417.

This a review of Mr. Winge's 14th annual report (for 1896), which includes reports of 1048 birds of 65 species killed at 35 lights. In the past 10 years, 134 species were recorded killed at the various locations.

501. Morgan, A., and R. P. Emery. 1955. Spring season: northeastern maritime region. Audubon Field Notes 9(4):317-318.

A Green-tailed Towhee killed at a Cape Sable, Nova Scotia light is noted.

502. Mosman, D. 1975. Bird casualties at Alleman, Ia. TV tower. Iowa Bird Life 45(3):88-90.

Casualties at this 2000-foot tower numbered 1641 (67 species) in fall 1973, 212 of 37 species in spring 1974, and 3521 of 57 species in fall 1974. The tower was usually checked following overcast nights because this is when most losses seemed to occur. However, 496 birds were killed on the night of 13 September 1974 when visibility was excellent. The author estimates 10% of the kill was not found due to heavy ground cover. Very few dead birds were found beyond 200 feet from the tower. Complete kill lists for all three seasons are provided (Knauth 1972).

503. _____. 1976. TV tower help needed. Iowa Bird Life 46(4):121.

This is an appeal for more people to get involved in the study of bird losses at TV towers in Iowa.

504. Mudge, J. E., and R. W. Firth. 1975. Evaluation of cooling tower ecological effects - an approach and case history. Proc. 21st Ann. Meeting Am. Nucl. Soc. 8 pp.

Results of the study at the Three Mile Island station in Pennsylvania are presented. Bird strikes during the period July 1973-May 1975 totalled 64 at the four cooling towers with five being the largest single-night kill recorded. Vireos, kinglets, and warblers comprised the majority of the casualties. No correlation was noted between weather conditions and bird strikes.

505. Mumford, R. E. 1960. Fall migration: middlewestern prairie region. Audubon Field Notes 14(1):38-41.

Two tower kills from fall 1959 are reported: 49 dead birds at South Bend, Ind. on 27 September and 88 at a 983-foot tower in Orion, Ill. on 6-7 October. The kills were dominated by Swainson's Thrushes and warblers.

506. _____. 1961. Fall migration: middlewestern prairie region. Audubon Field Notes 15(1):44-46.

On the night of 19-20 September 1960, 281 birds of 25 species (mostly thrushes and warblers) died at a TV tower in Davenport, Iowa. About 300 birds were killed at the Bunker Hill, Ind. airport ceilometer during September.

507. Munro, J. A. 1924. A preliminary report on the destruction of birds at lighthouses on the coast of British Columbia. Can. Field-Nat. 38(8):141-145, 38(9):171-175.

Of 45 lighthouses surveyed, nine reported heavy losses, and the overall annual losses were over 6000 birds. Flashing and revolving lights were more destructive than were fixed ones. Summaries for each lighthouse are given.

508. Murarka, I. P., A. J. Policastro, J. G. Ferrante, E. W. Daniels, and G. J. Marmer. 1976. An evaluation of environmental data relating to selected nuclear power plant sites - a synthesis and summary with recommendations. Div. Environ. Impact Stud., Argonne Natl. Lab., Argonne, Ill. Rep. No. ANL/EIS-8. 23 pp.

Seven sites were studied in this one year investigation, with the emphasis on hydrothermal, water quality and biocide, and aquatic ecological effects. No data are presented on bird losses due to collisions with cooling towers and transmission lines but losses are characterized as few and were regarded as "a minimal impact from the operation of the power plants." (Pentecost and Murarka 1976).

509. Murie, O. J. 1959. Fauna of the Aleutian Islands and Alaska Peninsula. North Am. Fauna No. 61. 364 pp.

Mostly Forked-tailed Petrels and a few Leach's Petrels are reported to be attracted by ship's lights at night in the Aleutian Islands.

510. Murray, J. J. 1929. A dead Clapper Rail found at Lexington, in the valley of Virginia. Auk 46(1):106-107.

The bird was found entangled on a barbed wire fence in November 1928.

511. Murton, R. K. 1971. Man and birds. Collins, London. 364 pp.

Bird strikes at power and communication lines are mentioned and damage done by birds to utility wires and poles is discussed.

512. Myers, L. H. 1977. Sage Grouse collisions on Ten Mile power line (230 kV). U.S. Dep. Inter., Bur. Land Manage. Unpubl. memorandum. 3 pp.

During springs 1975 and 1976, in Montana, four checks were made along 2 1/2 miles of power line and eight dead Sage Grouse were recovered. Severe mutilation of necks, wings, breasts and abdomen were noted. Sage Grouse fly at heights of 30-40 feet, making them susceptible to collisions with transmission lines.

513. Nelson, M. 1975. Power lines and birds of prey. Aware Mag. 52:9-12.

In Idaho, studies were made to determine ways of reducing the electrocution hazard to eagles. Slow-motion photography was used to examine eagle take-off and landing behavior at utility poles. Simple design changes in the poles and positions of wires can greatly reduce the possibility of electrocutions. Because an estimated 2% of utility poles cause an estimated 95% of the accidents, changes to reduce electrocutions do not have to be extensive. Often just the addition of a wooden perch above the dangerous power line is the best solution (Miller et al. 1975).

514. _____. 1978. Preventing electrocution deaths and the use of nesting platforms on power poles. Idaho Power Co. Unpubl. rep. 6 pp.

The problem of electrocutions on utility lines with voltages below 69 kV has been solved except for the lightning or pole ground wire. Some power companies have eliminated this hazard by cutting a four inch gap in the pole ground wire, but others haven't adopted this technique yet. The development of a safe, sturdy nesting platform for use on utility poles is described.

515. Nelson, M. W., and P. Nelson. 1976. Power lines and birds of prey. Idaho Wildl. Rev. 28(5):3-7

This account describes the results of research begun 1972 to eliminate the electrocution hazard to large birds of prey, especially eagles. Nationally, it is estimated that 300 to 2,000 eagles are shot or electrocuted at power lines annually. The author used 16 mm movies of a trained eagle to analyze take-off and landing behavior on utility poles. It was found that eagles selectively use certain poles as perches and that 98% of the eagles electrocuted were inexperienced birds. It was estimated that 95% of the electrocutions could be prevented by modifying just 2% of the poles. The best modification often involved only adding a wooden perch three feet above conductors. In addition, safe nesting platforms were developed in cooperation with the Idaho Power Company to be used on poles where eagles habitually build nests. This represents a significant extension of nesting habitat in an area where natural nest sites are scarce (Nelson 1975).

516. _____. 1977. Power lines and birds of prey. Pages 228-242 in R.D. Chancellor, ed. World Conference on Birds of Prey. International Council for Bird Preservation. Vienna 1-3 October 1975.

This is substantially the same as Nelson and Nelson 1976.

517. Nero, R. W. 1961. Regina TV tower bird mortalities - 1961. Blue Jay 19(4):160-164.

At the 670-foot CKCK tower, 94 dead birds of 22 species were found on 3 September and 113 of 20 species were collected on 10 September. Kill lists and weather conditions are given. The possibility of substantial losses occurring in daylight hours is discussed.

518. _____. 1962a. Fall migration: northern Great Plains region. Audubon Field Notes 16(1):47-50.

The largest tower kill ever reported from this region occurred at Regina, Sask. in September 1961 (Nero 1961).

519. _____. 1962b. Regina TV tower mortality, May 11-12, 1962. Blue Jay 20(4):151-152.

A list of 59 birds of 6 species found dead at the CKCK tower in Regina, Sask. is given. Among the casualties were 48 thrushes. South to southeast winds and overcast prevailed.

520. _____. 1963. Fall migration: northern Great Plains region. Audubon Field Notes 17(1): 40-44.

TV tower kills in fall 1962 at Regina, Sask. and in Manitoba are mentioned.

521. _____. 1974. Great Gray Owl impaled on barbed wire. Blue Jay 32(3):178-179.

In March, near Winnipeg, Manitoba, a Great Gray Owl became impaled by its wing on a barbed-wire fence and subsequently died.

522. Nesbitt, S. A., and D. T. Gilbert. 1976. Powerlines and fences hazards to birds. Fla. Nat. 49(2):23.

A Sandhill Crane was killed on a foggy February morning when it collided with a power line near Gainesville, Fla. Such collisions may be a major mortality factor for cranes and other birds such as herons, waterfowl and raptors. Careful siting of power lines is important to minimize their impact.

523. Newman, R. J. 1955a. Fall migration: central southern region. Audubon Field Notes 9(1):31-34.

Large ceilometer kills were reported from Nashville, Tenn. (255 killed on the night of 6-7 October 1954) and Birmingham, Ala. (1283 of 36 species on 7-8 October). Weather conditions and a kill list for the latter location are given. (See Laskey 1954 for details of the Nashville incident.)

524. _____. 1955b. Spring migration: central southern region. Audubon Field Notes 9(4): 335-338.

During the spring, over 100 birds of 17 species were killed at a new 1001-foot TV tower in Baton Rouge, La.

525. _____. 1956a. Fall migration: central southern region. Audubon Field Notes 10(1):29-32.

During the night of 24-25 September 1955, 1348 birds of 51 species died at a ceilometer in Smyrna, Tenn. (Laskey 1956a). At the ceilometer in Memphis, birds were observed beam on 12 October, but only one casualty was reported.

526. _____. 1956b. Spring season: central southern region. Audubon Field Notes 10(4):338-341.

In April, over 100 birds were killed at the Baton Rouge, La. TV tower.

527. _____. 1957. The changing seasons. Audubon Field Notes 11(1):4-6.

Mention is made of a kill of 2500 birds at a Chapel Hill, N.C. TV tower.

528. _____. 1958a. The changing seasons. Audubon Field Notes 12(1):4-9.

Included is a brief general discussion of the tower kill situation and an appeal for more systematic monitoring of towers and reporting of findings.

529. _____. 1958b. Fall migration: central southern region. Audubon Field Notes 12(1):36-39.

Several incidents of mortality were reported in fall 1957. The total kill at a Nashville, Tenn. tower was 704 birds of 67 species (Laskey 1957), and about 1000 birds of 36 species died on 23-24 September at a Baton Rouge, La. tower (Anon. 1957). At a ceilometer in Pensacola, Fla., 268 birds of 17 species were killed on 4-5 October and 14 were killed on 5-6 October. In the early morning of 24 September, many birds were reported flying wildly into buildings in downtown Gulfport, Miss. An estimated 1000 birds, mostly Common Yellow-throats, died in an area where the tallest building is four stories and most are just one story.

530. _____. 1959a. The changing seasons. Audubon Field Notes 13(1):4-10.

Towers in Nashville, Tenn. and Leon Co., Fla. reported reduced losses during fall 1958. Many airports in the Hudson-St. Lawrence region reported losses, but no details are given. A boxful of dead birds was collected at a Dallas, Tex. tower, and over 500 birds were killed at a Boston, Mass. tower on the night of 19-20 September 1958.

531. _____. 1959b. Fall migration: central southern region. Audubon Field Notes 13(1):37-41.

The Nashville tower killed 222 birds in fall 1958 (Laskey 1960).

532. _____. 1960a. Fall migration: central southern region. Audubon Field Notes 14(1):41-47.

Several migration records from tower kills in fall 1959 are given.

533. _____. 1960b. Spring migration central southern region. Audubon Field Notes 14(4): 392-397.

At a Baton Rouge oil refinery, over 1000 migrants of 17 species were killed by a huge gas flame shooting at least 250 feet into the overcast sky. Most were burned beyond recognition, but some Red-eyed Vireos and Indigo Buntings were identifiable (Davis 1940). Only one dead bird was found at the nearby WBRZ-TV tower.

534. _____. 1961. Fall migration: central southern region. Audubon Field Notes 15(1):46-51.

The total fall 1960 mortality at two Nashville, Tenn. towers was 3683 birds of 77 species (Laskey 1960, Ogden 1960). Only 14 dead birds were collected at the WBRZ tower in Baton Rouge, La.

535. Newman, R. J., and R. F. Andrle. 1961. The changing seasons. Audubon Field Notes 15(1):4-9, 78-79.

Included is a thorough discussion of the fall 1960 tower mortality in North America and an appeal for more intensive coverage and complete publishing of kill lists. Shorebirds are of special interest because they seldom are killed at towers. Sparrows are killed more often than is commonly believed because they migrate later than other passerines and hence go unnoticed. Also, unlike warblers, vireos, etc., most sparrows are killed on clear nights.

536. Newman, R. J., and D. A. Lancaster. 1960. The changing seasons. Audubon Field Notes 14(1):4-9.

In a general summary of the fall 1959 tower kills in North America, it is pointed out that 98% of the losses occurred with an overcast sky, a 2000 - 3000 foot ceiling, and within 24 hours of the passage of a cold front or stationary front. At Friendship Airport in Baltimore, Md., 2000 birds were collected at the ceilometer on the morning of 11 October.

537. Newman, R. J., and G. H. Lowery, Jr. 1959. The changing seasons. Audubon Field Notes 13(4):346-352.

In spring 1959, tower kills were quite light, but bird losses at windows and power lines "attracted notice all over the nation". At Detroit, Mich., 284 birds were killed at a TV tower.

538. Newman, R. J., and S. L. Warter. 1959. Spring migration: central southern region. Audubon Field Notes 13(4):376-380.

In Baton Rouge, La., the lowest spring tower kill to date was recorded, with 18 birds (5 species) being the largest single day kill total.

539. Nichols, C. K. 1949. Fall migration: Hudson-St. Lawrence region. Audubon Field Notes 3(1):6-8.

At the Empire State Building in fall 1948, "many birds", including some Connecticut Warblers, were killed (Aronoff 1949).

540. _____. 1954. Fall migration: Hudson-St. Lawrence region. Audubon Field Notes 8(1):6-9.

A kill at the Empire State Building occurred on the rainy night of 22-23 September 1953. Total mortality was unknown, but 277 birds, including 19 warbler species, were collected.

541. _____. 1955. Fall migration: Hudson-St. Lawrence region. Audubon Field Notes 9(1):10-14.

On the night of 5-6 October 1954, over 2000 birds of 49 species were killed at the Westhampton, Long Island, N.Y. airport ceilometer, and 123 birds died at the Empire State Building. Blackpoll Warblers dominated the ceilometer kill (Elliot 1954).

542. _____. 1956. Fall migration: Hudson-St. Lawrence region. Audubon Field Notes 10(1):8-12.

On the foggy night of 19 October 1955, 156 birds of 17 species were killed at the Empire State Building. Two-thirds of the casualties were Yellow-rumped Warblers.

543. _____. 1958. The fall migration: Hudson-St. Lawrence region. Audubon Field Notes 12(1):13-17.

On 16 November 1957, 30 Hermit Thrushes died by striking telephone wires at a sea wall in North Seabright, N.J.

544. _____. 1959. The fall migration: Hudson-St. Lawrence region. Audubon Field Notes 13(1):13-17.

"Rather high" bird mortality was reported at airports in the region during fall 1958, but no details are given.

545. Niles, D. M., S. A. Rohwer, J. A. Jackson, and J. D. Robins. 1969. An observation of midwinter nocturnal movement and tower mortality of Tree Sparrows. Bird-Banding 40(4):322-323.

In late January, near Lawrence, Kans., 19 Tree Sparrows were killed at a 600-foot tower and two died at a 700-foot microwave tower. This is taken as evidence for occasional extensive mass midwinter movements by this species, probably in response to bad weather, such as snowstorms.

546. Nisbet, I. C. T. 1968. Weights of birds caught at night at a Malayan radio tower. Ibis 110(3):352-354.

Many birds are attracted to and some are killed at a floodlit tower atop Fraser's Hill (4450 feet above sea level) in Malaysia. This study deals with birds that were mist-netted and ringed in October 1965 and 1966 (Medway et al. 1968, 1970).

547. _____. 1970. Autumn migration of the Blackpoll Warbler: evidence for long flight provided by regional survey. Bird-Banding 41(3):207-240.

Collision mortality reports and banding records were used to examine the fall migration pattern of the Blackpoll Warbler. This species accounted for 5.2% of the 140,342 warbler casualties tabulated from kill reports at 135 sites throughout the eastern U.S. and Canada from 1884 to 1968. Blackpoll Warblers were abundant in kills on the Atlantic Coast from Nova Scotia to New York, and in West Virginia. They were relatively common in incidents around the Great Lakes and were generally rare in southern and southeastern States. A list of 155 references to nocturnal migrant mortality is included.

548. Noble, G. 1885. Destructive electric light towers. Forest and Stream 25:305.

During a rainy October night, 105 birds were killed at a light tower in Savannah, Ga. House Wrens, Common Yellowthroats, and Indigo Buntings were the most abundant species.

549. Nolan, V., Jr. 1952. The spring migration: middlewestern prairie region. Audubon Field Notes 6(4):248-249.

There was a possible correlation between species killed at the 350-foot Perry Monument in Lake Erie and species that "skulk". It is suggested that "skulking" species migrate at lower altitudes and are therefore more likely to strike the monument than are other species.

550. _____. 1954. Spring season: middlewestern prairie region. Audubon Field Notes 8(4):314-316.

About 100 birds of 18 species, including a female Kirtland's Warbler, were killed or injured at the Perry Monument in Lake Erie amidst a squall. Before the lights illuminating the monument were turned off, up to 100 birds per minute were seen passing through the lighted area.

551. _____. 1956. Spring season: middlewestern prairie region. Audubon Field Notes 10(4): 336-338.

On the night of 12 May, 70 birds of 23 species died at the Perry Monument in Lake Erie.

552. Nolan, V., Jr., and R. E. Mumford. 1965. An analysis of Prairie Warblers killed in Florida during nocturnal migration. Condor 67(4):322-338.

An examination of 448 Prairie Warblers obtained from the WCTV tower near Tallahassee (Stoddard and Norris 1967) revealed that males precede females in spring migration. In the fall, the first 18 casualties were immatures, but after mid-August, the proportion of the kill contributed by each sex/age class did not vary. Data on fat content, molt, plumage, parasites, and mensural characteristics are included.

553. Nooe, S. H. 1956. Charlotte ceilometer kill. Chat 20(1):20-21.

A list of 114 birds of 24 species (primarily Red-eyed Vireos and Ovenbirds) killed during the night of 25 September is given.

554. Norman, J. L. 1975. Birds killed at a TV tower near Coweta, Oklahoma. Bull. Okla. Ornithol. Soc. 8(3):25-27.

Among the 177 casualties (28 species) killed at the KTUL tower on 9 October 1974 were 64 Nashville Warblers. Smaller kills (24 birds, 12 species) were recorded in late September. All casualties are listed.

555. _____. 1976a. Birds killed at a TV tower near Coweta, Oklahoma. Bull. Okla. Ornithol. Soc. 9(3):20.

During 12-15 September 1975, 99 birds of 27 species were collected at the KTUL tower. Casualties are listed by date.

556. _____. 1976b. Second and third specimens of Yellow Rail for Oklahoma. Bull. Okla. Ornithol. Soc. 9(4):33.

The specimens found on 27 September and 3 October, were among the fall 1976 casualties at the KTUL TV tower, near Coweta (Norman 1977).

557. _____. 1977. Birds killed at a TV tower near Coweta, Oklahoma in the fall of 1976. Bull. Okla. Ornithol. Soc. 10(1):6-8.

During September and October, 166 birds of 49 species were collected at the KTUL tower. A list, by date of collection, of the casualties is given.

558. Norris, R. A. 1963. Birds of the AEC Savannah River Plant area. Contrib. Charleston Mus. No. 14. 78 pp.

Included in this annotated bird list are records of over 1100 migrants of 80 species killed at the 1300-foot TV tower in Aiken Co., S.C. from August to mid-November 1957. Dates of kill and fat content are given; other data are on file.

559. Norwood, J. R. 1960. TV tower casualties at a Charlotte station. Chat 24(4):103-104.

In late September and early October 1960, 390 birds of 32 species were found dead at the 1000-foot WSOC TV tower in Charlotte, N.C. A kill list is given.

560. Oberholser, H. C. 1939. The season: Washington (D.C.) region. Bird-Lore Suppl. 130:5-6.

The following statement is included in the report: "It is evident that the Washington Monument has been taking its toll of birds during the migrations of August and September." (See the articles by Overing.)

561. Ogden, J. 1960. Observations at a T.V. tower during a bird fall. Migrant 31(4):65-67.

During the night of 28-29 September, 321 birds of 30 species were killed at the WSM TV tower in Nashville, Tenn. No "chips" were heard early, when the sky was clear, but when it became overcast, the "chip" count increased and birds started falling. The "chip" count decreased when the sky partially cleared, but birds continued to fall at a steady rate from 0030 to 0500. Many injured and stunned birds were observed at the tower.

562. Ogilvie, M. A. 1967. Population changes and mortality of the Mute Swan in Britain. Wildfowl Trust, 1965-1966. 18:64-73.

Of 1051 birds whose cause of death was known, 44% died from collisions with wires.

563. _____. 1978. Wild geese. Buteo Books, Vermillion, S.D. 350 pp.

Geese sometimes strike overhead wires, radio masts, and other obstacles, particularly in foggy weather and at night.

564. Olendorff, R. R. 1972. Eagles, sheep and power lines. Colo. Outdoors 21(1):3-11.

In the second half of this article, the author discusses the problem of Golden Eagles and other birds of prey being electrocuted in the Pawnee National Grassland, Colo.

565. Olsson, V. 1958. Dispersal, migration, longevity and death causes of Strix aluco, Buteo buteo, Ardea cinerea and Larus argentatus. Acta Vertebr. 1(2):91-189.

Recoveries of birds ringed in Sweden, Norway and Finland showed that "found dead under power-line" was the cause of death given for 30 of 371 Tawny Owls, 11 of 473 Common Buzzards, 8 of 979 Common Herons, and 9 of 1251 Herring Gulls. In the latter three species, "shot" was the most common cause of death.

566. Overing, R. 1936. The 1935 fall migration at the Washington Monument. Wilson Bull. 48(3):222-224.

Bird mortality at the structure increased in 1932 when floodlights were installed to illuminate the 555-foot shaft. In fall 1932 and 1933, 324 and 331 were killed there, respectively. In fall 1935, 246 birds of 33 species (mostly Red-eyed Vireos and warblers) were found dead, as well as three red and one little brown bat. On one occasion, "hundreds of Field Sparrows" perched on benches while warblers and vireos were being confused by the lights and flying against the monument. Most birds struck the east face of the structure although the wind was usually westerly. A kill list is provided.

567. _____. 1937. The 1936 fall migration at the Washington Monument. Wilson Bull. 49(2):118-119.

The seasonal mortality was 277 birds of 30 species, 196 of the losses occurring on 17 and 18 September. Red-eyed Vireos and warblers dominated the kill list. In addition, several bats were killed.

568. _____. 1938a. The 1937 fall migration at the Washington Monument. Wilson Bull. 50(2): 146.

The highest seasonal yet, 945 birds of 43 species, was recorded. On 12 September, from 2230 to 2400, 576 birds were killed. As in the two previous falls, Red-eyed Vireos, Common Yellowthroats, and Magnolia Warblers comprised the majority of the casualties.

569. _____. 1938b. High mortality at the Washington Monument. Auk 55(4):679.

On the night of 12 September 1937, 576 birds of 24 species were killed. The day was clear but there was mist around the top of the shaft at night. A kill list is given.

570. Owen, M., and C. J. Cadbury. 1975. The ecology and mortality of swans at the Ouse Washes, England. Wildfowl 26:31-42.

Of 128 instances where the cause of death was known, 49 (38%) were due to collisions with power lines.

571. Packard, C. M. 1958. Bird mortality during a migration. Maine Field Nat. 14(4):83-85.

During the night of 16-17 September, 198 birds of 28 species died at the Portland, Me. airport ceilometer. American Redstarts, Blackpoll, and Bay-breasted Warblers were the principal species. Over 30% of the birds were of species that breed only in northern coniferous forests.

572. Pangburn, C. 1945. Extraordinary fatality to a Blue-winged Teal. Auk 62(1):142.

The bird struck two overhead wires with such force that they were driven into the skull.

573. Parmalee, P. W., and B. G. Parmalee. 1959. Mortality of birds at a television tower in central Illinois. Bull. Ill. Audubon Soc. 111:1-4.

During the foggy, cloudy night of 16-17 September 1958, at least 827 birds of 40 species were killed at the 1000-foot WICS TV tower at Springfield, Ill. Weather conditions and a kill list are given.

574. Parmalee, P. W., and M. D. Thompson. 1963. A second kill of birds at a television tower in central Illinois. Bull. Ill. Audubon Soc. 128:13-15.

At the WICS tower in Springfield, Ill., 219 birds of 31 species were killed during the night of 12-13 September. Weather is discussed in detail and comparisons with an earlier kill (see preceding article) are made. A kill list is included.

575. Parnell, J. F. 1965. Fall migration: southern Atlantic coast region. Audubon Field Notes 19(1):25-28.

General references are made to birds killed at the Cape Hatteras, N.C. lighthouse during fall 1964.

576. _____. 1970. The fall migration: southern Atlantic coast region. Audubon Field Notes 24(1):31-33.

A tower kill at Raleigh, N.C. in fall 1969 is mentioned.

577. Patterson, M. 1970. Swainson's Warbler tower casualty. Migrant 41(4):78-79.

A young, female Swainson's Warbler and eight other birds (four species) were found dead at a microwave tower in central Tennessee on 15 October 1969.

578. Paulson, D. R., and H. M. Stevenson. 1962. Spring migration: Florida region. Audubon Field Notes 16(4):398-404.

A kill of 249 birds, almost half of which were Red-eyed Vireos, at the WCTV tower near Tallahassee on 7 April is mentioned.

579. Pentecost, E. D., and I. P. Murarka. 1976. An evaluation of environmental data relating to selected nuclear power plant sites - the Three Mile Island nuclear station site. Div. of Environ. Impact Stud., Argonne Natl. Lab, Argonne, Ill. Rep. No. ANL/EIS-4. 8 pp.

Bird losses due to collisions with plant's four 370-foot high cooling towers were monitored during 5-30 June and 1 September 30-November 1974. The only losses were seven birds found in October. A three to five year bird-kill monitoring program is recommended to insure adequate assessment of the stacks' impact on migratory birds under various weather conditions.

580. Perkins, J. P. 1964. 17 flyways over the Great Lakes- Part I. Audubon Mag. 65(5):294-299.

In Lake Superior, on the drizzly night of 20 August 1961, migrants by the dozen fluttered around lights of an ore-carrying steamer. Many were killed striking windows, but no count was taken. Red-eyed Vireos suffered heavy losses, but most of the migrants seen were identified as "small empidonax flycatchers". The migratory wave subsided at about 0300. Birds are regular visitors to the ship (Green and Perkins 1964).

581. Perrins, C. M., and C. M. Reynolds. 1967. A preliminary study of the Mute Swan, Cygnus olor. Wildfowl Trust Ann. Rep. 18:74-84.

Swan mortality due to striking wires is discussed.

582. Peterman, W. A. 1974. II. Weather and bird mortality. Bird hazard monitoring contract, Davis-Besse site. Semi-annual rep. June:14-20.

Weather patterns and bird mortality were examined during spring 1974 at the Davis-Besse power plant site, near Lake Erie in Ohio. High mortality seemed to be associated with cold fronts and storm activity. During the seven days when mortality was highest, cold fronts were the dominant weather feature (Williams and Jackson 1974).

583. Petersen, P. C., Jr. 1959. TV tower mortality in western Illinois. Bull. Ill. Audubon Soc. 112:14-15.

Following the foggy, overcast night of 6-7 October, 88 dead birds of 32 species were found dead at the 983-foot WHBF tower near Orion, Ill.

584. _____. 1963. The fall migration: middlewestern prairie region. Audubon Field Notes 17(1):36-37.

At Magnolia, Ky., 271 birds of 30 species were killed at a tower on 25 September 1962.

585. _____. 1964a. Fall migration: middlewestern prairie region. Audubon Field Notes 18(1):42-44.

Tower kills were reported on 26 August 1963 at Cedar Rapids, Iowa (mostly thrushes and warblers) and on 20-21 September at Columbia, Mo. (941 birds, mostly Red-eyed Vireos and Ovenbirds) (George 1963).

586. _____. 1964b. Spring migration: middlewestern prairie region. Audubon Field Notes 18(4):454-456.

Tower strikes at Columbia, Mo. on 11-12 May claimed 51 birds of 22 species.

587. _____. 1965. Fall migration: middlewestern prairie region. Audubon Field Notes 19(1): 44-46.

A kill of 300 birds occurred at a Cincinnati, Ohio tower on the night of 27-28 September 1964.

588. _____. 1966a. Fall migration: middlewestern prairie region. Audubon Field Notes 20(1):53-55.

Tower kills were reported from Dayton, Ohio (86 birds) and Floyd Co., Ind. (25 birds) in fall 1965.

589. _____. 1966b. Spring migration: middlewestern prairie region. Audubon Field Notes 20(4):513-515.

A kill of 35 birds was reported from the WHIO tower near Dayton, Ohio.

590. _____. 1967. Fall migration: middlewestern prairie region. Audubon Field Notes 21(1):44-45.

At Columbia, Mo. on 20 September 1966, 618 birds of 32 species were killed at the KOMU tower (Elder and Hansen 1967). In Floyd Co., Ind., on 22-23 September, 123 birds died. And at a tower in Dayton, Ohio, 305 birds of 49 species, mostly Red-eyed Vireos, Golden-crowned Kinglets, and Ovenbirds, died during fall 1966.

591. _____. 1968. Fall migration: middlewestern prairie region. Audubon Field Notes 22(1):48-50.

The WHIO tower at Dayton, Ohio killed 348 birds of 45 species (mostly Red-eyed Vireos and warblers) during 9 September-15 November 1967. At a tower in Floyd Knobs, Ind., over 78 birds (mostly thrushes and warblers) died on 6 and 7 October.

592. _____. 1969. Fall migration: middlewestern prairie region. Audubon Field Notes 23(1):64-65.

During 27 September- 11 October 1968, 145 casualties were recorded at the WHIO tower at Dayton.

593. _____. 1970. The fall migration: middlewestern prairie region. Audubon Field Notes 24(1):54-55.

On 6 October 1969, "a group of birds" struck the John Hancock Building in Chicago.

594. _____. 1971. Fall migration: middlewestern prairie region. Am. Birds 25(1):64-66.

At a tower near Springfield, Ill., 212 birds of 28 species died on 22-23 September 1970, and 37 birds of 16 species were killed on 13-14 October.

595. Peterson, (Mrs.) A. W. 1963. Destruction of birdlife in Minnesota- Sept. 1963. IV. Birds killed at Park Rapids. Flicker 35(4):113.

Following the densely foggy night of 15-16 September, the main street of town "was littered with dead or dying birds" probably as a result of migrants being attracted to street lights and smashing into buildings.

596. Peterson, R. L., and B. P. Glass. 1946. Notes on bird mortality during nocturnal thunderstorms near College Station, Texas. Condor 48(2):95-96.

In spring 1941, following severe storms with high winds, dead birds were collected on at least five occasions, including 16 Snow and Blue Geese beneath electrical power lines on 4 April.

597. Pettingill, O. S. 1970. Ornithology in laboratory and field. Burgess Publ. Co., Minneapolis. 4th ed. 524 pp.

In the section "Mortality in Migration", the author reviews the hazards posed by tall lighted structures to migrating birds. Included are summaries of the work by Howell, Laskey and Tanner 1954 and Graber 1968.

598. Pierce, M. E. 1969. Tall television tower and bird migration. S. Dak. Bird Notes 21(1):4-5.

Two sizable kills occurred in 1965 at the 1117-foot KSOO tower near Flandreau, S. Dak. During the night of 27-28 March, 578 Horned Larks died in a freakish snowstorm, either by colliding with the windows of the transmitter building or with the tower. Early in the morning of 14 September, 102 birds of 32 species were killed, mainly by striking windows on the building. A kill list is given. No other incidents involving more than a few birds occurred from July 1960 to May 1968.

599. Polshek, P. 1977. Fox preys on nocturnal migrants. Kingbird 27(1):28.

On 24 October 1976, at a Long Island, N.Y. beach, many migrants were seen flying around a lighted water tower or perched nearby. A red fox was jumping about trying to catch exhausted birds. The night was warm and overcast.

600. Post, S. 1976. Bird migration and window kills. Earlham College, Richmond, Ind. Unpubl. rep. 11 pp.

Bird casualties were collected at windows of various buildings at Earlham College during spring 1976. Checks were made three times daily on 40 days and 56 birds were collected. Most losses occurred during the afternoon at north-facing windows, perhaps because birds attempted to fly through the glass toward the brighter south windows which received direct sunlight.

601. Post, W., Jr. 1963. Tower casualties at Aiken, South Carolina. Chat 27(1):23.

On the night of 6-7 September 1962, 400 birds of 32 species were killed at the 1292-foot WJBF TV tower following the passage of a cold front. In addition, many live birds were seen around the tower. All birds examined were fat. Of the casualties, 239 were Red-eyed Vireos.

602. Post, W., and M. M. Browne. 1971. Seaside Sparrow hits a TV tower near Raleigh, North Carolina. Wilson Bull. 83(1):102-103.

This is the first direct evidence that this species is a nocturnal migrant.

603. Potter, J. K., and J. J. Murray. 1949. Fall migration: middle Atlantic coast region. Audubon Field Notes 3(1):8-10.

In a heavy fog, on the morning of 11 September 1948, "hundreds and perhaps thousands" of birds, mostly warblers, struck tall buildings and towers in Philadelphia. At Cape May, N.J., 50 species were collected at telegraph wires and radio towers in September and October. Two Barn Owls were among the casualties. This is the earliest reference we have to bird kills at towers.

604. _____. 1955. The fall migration: middle Atlantic coast region. Audubon Field Notes 9(1):15-17.

On 6 October 1954, 210 birds of 38 species were collected at the Allentown, Pa. ceilometer.

605. Pough, R. H. 1948. Out of the night sky. Audubon Mag. 50(6):354-355.

The influence of air masses on nocturnal migrants is discussed and related to bird strikes at tall structures. Southbound migrants are forced to fly at lower than normal altitudes when the cold air mass they are accompanying meets a northbound warm air mass. The cold front sinks below the warm air and the birds, staying with the favorable winds of the cold front, are forced to fly at heights that make them susceptible to collisions with tall structures such as the Empire State Building.

606. Purrington, R. D. 1969. Fall migration: central southern region. Audubon Field Notes 23(1):65-70.

At the WSM tower in Nashville, Tenn., 5408 birds (4857 warblers) died on the night of 25-26 September 1968. This figure is more than half of the total mortality from Nashville towers and ceilometers in the past 20 years (Laskey 1969a).

607. _____. 1970. The fall migration: central southern region. Audubon Field Notes 24(1): 55-61.

On the night of 14-15 October 1969, about 500 casualties were recorded at an illuminated rest area atop Oak Mt., Shelby Co., Ala. and additional losses were reported at the KAFB tower in Baton Rouge, La.

608. _____. 1971. The fall migration: central southern region. Am. Birds 25(1):66-71.

Kills at the Nashville, Tenn. towers during fall 1970 are mentioned.

609. _____. 1973. The fall migration: central southern region. Am. Birds 27(1):70-75.

Fall 1972 migration records from Nashville, Tenn. towers are mentioned.

610. _____. 1974. The fall migration: central southern region. Am. Birds 28(1):63-67.

During fall 1973, the Nashville tower kill was the lowest ever- 165 birds. The lack of major fronts in the area was probably the reason for the low total (Goodpasture 1974b).

611. _____. 1975. The fall migration: central southern region. Am. Birds 29(1):68-74.

Only 122 birds were collected at two Nashville, Tenn. towers in fall 1974, a new all-time low at that location (Goodpasture 1975.)

612. Quortrup, E. R., and J. E. Shillinger. 1941. 3,000 wild bird autopsies on western lake areas. J. Am. Vet. Med. Assoc. 99:382-387.

Mechanical injury (gunshot, wire strikes, etc.) accounted for 556 (18.5%) of the deaths.

613. Raible, R. 1968. Vogelverluste an Glasflachen und Methoden zu ihrer Verhutung. Angenandte Ornithol. 3(2):75-79.

Methods to reduce bird losses due to collisions with glass surfaces are discussed. Consideration given at the planning stages in the design and construction of buildings is important for effectively reducing losses. Techniques include the use of translucent or opaque glass, silhouettes, curtes, curtains, shrubs planted in front of glass surfaces, and extinguishing lights behind large glass surfaces at night. (From English summary.)

614. Rand, A. L. 1938. A modern bird fatality. Auk 55(3):547.

In California, a Mockingbird was electrocuted while perched on the antenna of a radio transmitter. In a note following this article, the editor reports of two instances of birds being electrocuted at power lines and poles.

615. Ranford, R. B., and J. E. Mason. 1969. Nocturnal migrant mortalities at the Toronto-Dominion Centre. Ont. Field Biol. 23:26-29.

Losses at two buildings, 600 and 740 feet tall, totalled 470 birds of 64 species in autumns 1967-69. White-throated Sparrows and Common Yellowthroats were the species most frequently killed. Kill lists are given. Largest losses preceded a cold front through the area. Stunned or fatigued birds that were picked up and released often headed immediately for lighted windows.

616. Ransom, W. H. 1929. Menace of lighted towers to birds. Murrelet 10(2):39.

A few ducks and geese were reported to have flown into the 600-foot fume stack of the Anaconda Copper Mining Co. at Great Falls, Mont. The lights are turned off during the fall to reduce losses. Also mentioned is a report that Turtle Doves and other birds are attracted to electric signs on the Eiffel Tower.

617. Raveling, D. G. 1965. Geographic variation and measurements of Tennessee Warblers killed at a TV tower. Bird-Banding 36(2):89-101.

Casualties from the Eau Claire, Wis. tower in fall 1961 and 1962 were analyzed. Various measurements were taken and compared with those from other areas. Bill length showed a significant geographical variation.

618. Raveling, D. G., and E. A. LeFebvre. 1967. Energy metabolism and theoretical flight range of birds. Bird-Banding 38(2):97-112.

Tennessee Warblers from a kill at the Eau Claire, Wis. tower on 2-3 October 1962 were used in this study.

619. Raveling, D. G., and D. W. Warner. 1965. Plumages, molts, and morphometry of Tennessee Warblers. Bird-Banding 36(3):169-179.

Specimens from fall 1961 and 1962 kills at Eau Claire, Wis. and museum skins were used. Significant differences between sex-age classes in bill, tarsus, wing, tail, and overall length were found in most cases. In males, wing length and plumage can be used to distinguish between sexes and between age classes.

620. _____. 1978. Geographic variation of Yellow Warblers killed at a TV tower. Auk 95(1):73-79.

An examination of 74 Yellow Warblers killed on 9-10 September 1962 at Westport, Minn. (Kemper et al. 1966), and comparison with museum specimens, showed that birds of this species originating from as far apart as 3220 km were migrating southward together.

621. Reitz, R. 1954. Birds meet with disaster at the Brunswick Naval Air Station. Bull. Maine Audubon Soc. 10(4):61-62.

During the foggy night of 8-9 September, 500-1000 birds of at least 13 species were killed by smashing into hangar doors which may have been attractive because they were wet and reflected light. Swainson's Thrushes were the most abundant of the species killed.

622. Rew, F. M. 1974. Bird kill- BOCES tower- town of Pomfret, Chautauqua County. Prothonotary 40(9):103-104.

Kills on 24, 29 and 30 August totalling 51 birds of 19 species are listed from this western New York site.

623. Ridgway, R. 1885. A new petrel for North America. Auk 2(4):386-387.

A White-faced Stormy Petrel was taken in the north Atlantic Ocean late in the evening of 2 September 1885 after presumably being attracted to the light of the ship.

624. Riegel, M., and W. Winkel. 1971. On death causes of White Storks (C. ciconia) according to ringing recovery reports [in German, English summary]. Die Vogelwarte 26(1):128-135.

In Germany, of 294 storks for which the cause of death was known, 226 (77%) died from collisions with telegraph wires. Inexperienced birds are more prone to strike telegraph wires than are older birds. (From English summary.)

625. Rintoul, L. J., and E. V. Baxter. 1914. Notes on some passerine birds migrating in moult. Scott. Nat. 35:245-252.

Casualties from lighthouses in Scotland were examined.

626. Rix, C. E. 1970. Birds of the Northern Territory. S. Aust. Ornithol. 25(6):147-190.

In July 1967, near Darwin, five dead Jabiru (Black-necked Storks) were found beneath a power line at Fogg Dam. Fourteen live birds were also present.

627. Robbins, S. D. 1967. Fall migration: western Great Lakes region. Audubon Field Notes 21(1):36-38, 42-44.

On 14 September 1966, 2117 birds of 37 species were found dead at a tower in Eau Claire, Wis. Similarities were noted between the most abundant species in the kill and those recorded in the field. The difficulty in judging migration via just one method is discussed.

628. _____. 1968. Fall migration: western Great Lakes region. Audubon Field Notes 22(1): 40-44, 47-48.

Moderate kills of 50-175 birds were recorded at the WEAU tower in Eau Claire, Wis. on 8, 14, and 27 September 1967. At two shorter towers in Madison, Wis., 25 birds died on the night of 16-17 September.

629. _____. 1969. Fall migration: western Great Lakes region. Audubon Field Notes 23(1):55-56, 64.

A kill of over 2000 birds occurred at the WEAU tower in Eau Claire, Wis. on 19-20 September 1968, and 145 birds died there on 18-19 October, two weeks later than any previous kill at the site. The October kill was composed chiefly of kinglets and late migrant warblers.

630. Roberts, T. S. 1936. The birds of Minnesota. University of Minnesota Press, Minneapolis. Vol. 2. 850 pp.

A Nelson's Sharp-tailed Sparrow, other sparrows, and many warblers were killed by flying against an electric light at Dodge Center, Minn. on 26 May 1927 (p. 396).

631. Robertson, W. B., Jr. 1968. Spring migration: Florida region. Audubon Field Notes 22(4): 516-520.

Various spring migration records from kills at the WCTV tower near Tallahassee are noted. On 4-5 May, 137 Bobolinks were killed.

632. _____. 1970. The fall migration: Florida region. Audubon Field Notes 24(1):33-38.

Hundreds of migrants congregated around a lighthouse off Caibarien, Cuba on the rainy night of 14 October 1969. More than 30 birds were found dead the next day including Yellow-billed Cuckoos, thrushes and warblers. Tower kills were reported from Jacksonville, Tallahassee, and Orlando.

633. _____. 1971. The fall migration: Florida region. Am. Birds 25(1):44-49.

Five kills, primarily of warblers, were reported during 28 September-22 October 1970: 2790 birds (51 species) at WBDO in Orlando; 237 (53) at WCTV, Tallahassee; 300-400 at WCIX, Homestead; 146 at Jacksonville; and 31 at Vero Beach. Weather conditions are discussed. (See Bagg 1971 for kill lists of the Orlando and Jacksonville incidents.)

634. _____. 1972. The fall migration: Florida region. Am. Birds 26(1):50-54.

It was a "rather quiet fall" at towers due to "settled weather". Local conditions, not associated with frontal activity, led to a kill of 152 birds of 41 species at WCTV, Tallahassee on the night of 19-20 October 1971; total seasonal losses there were 409 birds.

635. Robertson, W. B., Jr., and J. C. Ogden. 1968. Fall migration: Florida region. Audubon Field Notes 22(1):25-31.

Fall 1967 losses at WCTV, Tallahassee totalled 508. A few dozen birds died at the WCIX tower, Homestead, and 174, predominately Ovenbirds, were killed at two towers in Jacksonville on the night of 2-3 September.

636. _____. 1969. Fall migration: Florida region. Audubon Field Notes 23(1):35-40.

In fall 1968, 853 birds of 80 species were killed at the WCTV tower, Tallahassee.

637. Robertson, W. B., Jr., and D. R. Paulson. 1961. Fall migration: Florida region. Audubon Field Notes 15(1):26-35.

The fall 1960 kill of 1140 birds at WCTV, Tallahassee is discussed. Several species not considered to be nocturnal migrants were found among the casualties. The absence of shorebirds in kills is tentatively attributed to better night vision and/or higher flight altitudes (see Able 1963). Sparrows accounted for 60% of 348 November casualties.

638. Robertson, W. B., Jr., and H. M. Stevenson. 1957. Spring migration: Florida region. Audubon Field Notes 11(4):337-342.

At Jacksonville, 279 birds were killed on 10 May, and losses at WCTV, Tallahassee are mentioned.

639. Robson, J. E. 1969. Dipper flying into barbed-wire fence. Br. Birds 62(11):498.

A juvenile Cinclus cinclus impaled itself on a fence in England.

640. Rogers, D. T. 1965. Fat levels and estimated flight ranges of some autumn migratory birds killed in Panama during a nocturnal rainstorm. Bird-Banding 36(2):115-116.

The birds were killed by striking telephone poles and other obstacles during the storm. Swainson's Thrushes were the most abundant among the 17 specimens collected.

641. Rogers, T. 1958. Fall migration: Palouse-northern Rocky Mountain region. Audubon Field Notes 12(1):45-47.

In fall 1957, many Western Tanagers were killed by striking windows in Bozeman, Mont.

642. _____. 1959. Spring migration: northern Rocky Mountain-intermountain region. Audubon Field Notes 13(4):388-390.

On the cloudy night of 29-30 April, migrating sparrows, mostly White-crowned, suffered large casualties by striking buildings in Baker, Ore. Many Lapland Longspurs were killed by flying into lights and buildings during a nighttime snowstorm on 5 May in Calgary, Alberta.

643. Rosche, R. C. 1966. Fall migration: western New York and northwestern Pennsylvania. Audubon Field Notes 20(1):38-41.

Sixty dead birds of 20 species were collected at the 1076-foot WKBW tower near Colden, N.Y. following two foggy nights in fall 1965. Kill lists are provided.

644. _____. 1967. Fall migration: western New York and northwestern Pennsylvania. Audubon Field Notes 21(1):29-32.

A 843-foot tower at Elmira, N.Y. accounted for 270 dead birds in fall 1966, 200 on 19-20 September alone. Twelve other towers were checked throughout the season, yielding 97 additional casualties, compared to over 200 from four towers in 1965. Ovenbirds dominated the 1966 kills. (See the articles by W. I. Howard 1963-1974 for details of the Elmira tower kills.)

645. _____. 1968. Fall migration: western New York and northwestern Pennsylvania. Audubon Field Notes 22(1):35-37.

The 1967 fall kill at Elmira, N.Y. was 45, the lowest total yet.

646. _____. 1969. Fall migration: western New York and northwestern Pennsylvania. Audubon Field Notes 23(1):46-49.

In fall 1968, one brown bat and 270 birds (34 species) were killed at the Elmira, N.Y. tower.

647. _____. 1970. The fall migration: western New York and northwestern Pennsylvania. Audubon Field Notes 24(1):43-47.

Over 300 casualties from the Elmira, N.Y. tower in fall 1969 are summarized. Bay-breasted Warblers were the most common victims.

648. _____. 1971. The fall migration: western New York and northwestern Pennsylvania. Am. Birds 25(1):54-57.

Regular monitoring of three locations in fall 1970 yielded over 2100 casualties of 70 species. At the Elmira, N.Y. tower, 220 dead birds of 40 species were recovered.

649. _____. 1972. The fall migration: western New York and northwestern Pennsylvania. Am. Birds 26(1):60-62.

In the western part of the region, 313 birds of 26 species were found dead at five towers during 29-31 August 1971. At Elmira, N.Y., 540 casualties of 55 species (mostly warblers), the highest fall total yet there, were collected. Of the losses, 225 occurred on 29-30 September and 78 (kinglets, juncos, sparrows) on 25 October.

650. _____. 1973. The fall migration: western New York and northwestern Pennsylvania. Am. Birds 27(1):56-59.

Throughout the region, "generally light kills" were reported during fall 1972. At Elmira, N.Y., 140 dead birds of 30 species were collected.

651. _____. 1974. The fall migration: western New York and northwestern Pennslyvania. Am. Birds 28(1):49-51.

Several kills were reported during fall 1973. In Erie Co., N.Y., kills of 44 and 104 birds were found at two towers. A large migratory flight occurred during the night of 24 September, and eight dead and many exhausted birds were found around Xerox Square in Rochester, N.Y. A few casualties were found at a tower near Alfred, N.Y. on 25 September. In Buffalo, 15 birds, mostly Yellow-bellied Sapsuckers, were found dead at a tall building. At Elmira, N.Y., 465 birds of 40 species, the largest single kill ever, were found dead on 28 September; through 18 October, the seasonal total was 575.

652. Ross, R. C. 1946. People in glass houses should draw their shades. Condor 48(3):142.

The large number of Swainson's Thrushes killed by flying into windows is explained by their habit of flying along aisleways in the understory toward lighted openings. Unfortunately, some aisleways end at window panes (Snyder 1946 and Willet 1945).

653. Rural Electrification Administration. 1972. Powerline contacts by eagles and other large birds. U.S. Dep. Agric. REA Bull. 61-10. 6 pp.

Inexpensive modifications to make electric power transmission poles safer for eagles and other large birds are discussed and diagrammed.

654. Rybak, E. J., W. B. Jackson, and S. H. Vessey. 1973. Impact of cooling towers on bird migration. Proc. Bird Control Seminar, Bowling Green State Univ. 6:187-194.

During fall 1973, 102 birds of 24 species (mostly kinglets and warblers) and 1 big brown bat were found dead at a 495-foot cooling tower and a 240-foot reactor building at the new nuclear power station near Port Clinton, Ohio. Tower kills including 16 additional species occurred in fall 1972 and spring 1973 during construction of the station. Studies suggested that half of the dead specimens were removed by nocturnal mammalian scavengers before searches by the investigators in the morning. Also mentioned is the reduction of bird losses from as high as hundreds a night to "minimal" following removal of nighttime floodlighting at the Perry Monument on nearby South Bass Island in Lake Erie.

655. Sanger, G. A. 1973. New northern record for Xantus' Murrelet. Condor 75(2):253.

A Xantus' Murrelet crashed into the bridge of a ship near Vancouver Island on the night of 25 October 1971.

656. Saunders, W. E. 1930a. The destruction of birds at Long Point Lighthouse, Ontario, on four nights in 1929. Auk 47(4):507-511.

Kill lists are given for 7 September (654 birds, 36 species), 9 September (169, 26), and 24-29 September (1237, 49). Of the 55 species represented, Common Yellowthroats (254) Blackpoll Warblers (236), Red-eyed Vireos (176), Swainson's Thrushes (168), Gray-cheeked Thrushes (153), and Ovenbirds (146) were the most numerous. Some casualties may have been taken by Sharp-shinned Hawks or skunks.

657. _____. 1930b. Bats in migration. J. Mammal. 11(2):225.

In addition to bird losses in excess of 2000 (see above), three red bats, one hoary bat, and one silver gray bat were killed at the Long Point, Ont. lighthouse in fall 1929.

658. Savage, T. 1963. Bird mortality near Gatlinburg, September 21-22, 1963. Migrant 34(3): 56-57.

A brightly lit ski lift claimed 144 birds of 30 species. A list is given.

659. _____. 1965. Casualties at ski resort, Gatlinburg. Migrant 36(4):81-82.

Bright lights and fog caused birds to collide with various structures at a Tennessee ski resort and condominium in late September and early October. A list of 1915 casualties (42 species) is given. Thrushes and Ovenbirds dominated.

660. Sawyer, P. J. 1961a. Bird mortality at the WENH-TV tower in Deerfield, New Hampshire. New Hampshire Audubon Q. 14(2):46-49.

In 1959 and 1960, 267 birds of 45 species were found dead at this 436-foot tower atop a 1100-foot mountain. Spring casualties (47 birds) were distributed more or less randomly around the tower whereas 90% of the 220 fall losses were southeast of the structure. Kill lists are given.

661. _____. 1961b. Report on the cause of mortality and the morphometry of seventy Ruby-crowned Kinglets killed at the WENH-TV tower in Deerfield, New Hampshire. Bird-Banding 32(3):162-168.

Of 130 birds killed at this 436-foot tower on 13-14 October 1959, 74 were Ruby-crowned Kinglets. Weights and various measurements are presented and compared with respect to sex and age. Weather conditions associated with the incident are described.

662. Scheider, F. 1959. Region 5- Oneida Lake basin. Kingbird 8(4):121-125.

On 18-19 September, 45 birds, mostly thrushes, vireos and warblers, were collected at the WHEN-TV tower in Syracuse, N.Y. On 16 September, numerous dead birds were noted in downtown Syracuse, and on the 17th, hundreds of birds were seen and dozens were killed at the Rome, N.Y. Air Base searchlight.

663. _____. 1960. Region 5- Oneida Lake basin. Kingbird 9(4):170-176.

On 2 and 3 October 1959, about 110 birds, mostly warblers and vireos, were found dead at two towers in upstate New York.

664. Schmitz, J. P. 1969. Vogelverluste an Glasflachen des Athenaums in Luxemburg. Regulus 9:423-427.

Bird mortality at glass windows is discussed. A list of 408 casualties (34 species) is provided.

665. Schorger, A. W. 1952. Ducks killed during a storm at Hot Springs, South Dakota. Wilson Bull. 64(2):113-114.

On the night of 25 October 1951, amidst rain, snow and fog, many ducks, mostly Redheads and Mallards, were killed by colliding with buildings, trees, telephone poles and wires, and other obstacles.

666. Schotzko, J. 1962. Interrupted migration. Flicker 34(2):61.

On the night of 12 September 1961, hundreds of birds were seen fluttering around street and store lights and crashing into windows in Paynesville, Minn. About 4000 stunned and confused birds were observed in a 3-block area. The mortality included over 200 warblers.

667. Schroeder, C. H. 1977. Geese hit power transmission line. N. Dak. Outdoors 40(2): inside front cover.

Near Hankinson, N. Dak., 46 Snow Geese (15 white phase and 31 blue phase) were found dead near a power line on the morning of 22 April 1977. Apparently the birds struck the line early in the morning even though weather was clear, mild, and fogless.

668. Schultz, Z. M. 1958. Fall migration: north Pacific coast region. Audubon Field Notes 12(1):52-54.

In Seattle, Wash., during fall 1957, dozens of Cedar Waxwings died by striking windows.

669. Scott, F. R., and D. A. Cutler. 1965. Fall migration: middle Atlantic coast region. Audubon Field Notes 19(1):21-24.

On the night of 11-12 September 1964, thousands of birds were killed at a 1000-foot tower in Baltimore, Md. Among the 1032 casualties examined (37 species) were over 300 Ovenbirds. More than 100 birds of 23 species died at a Lynchburg, Va. ceilometer on the night of 4-5 October.

670. _____. 1967. Fall migration: middle Atlantic coast region. Audubon Field Notes 21(1): 15-19.

Birds of 40 species, including over 400 warblers, were found dead at a Baltimore, Md. tower on 26 September 1966. No exact count of the losses is given (Bush 1967).

671. _____. 1971. The fall migration: middle Atlantic coast region. Am. Birds 25(1):36-40.

On 28 September 1970, 1965 birds of 42 species died at the WBAL-TV tower in Baltimore, Md. Ovenbirds (489) and Red-eyed Vireos (410) dominated the kill. (See Bagg 1971 for a complete species list.) Also, "bad kills" were reported from the Chesapeake Bay Bridge-Tunnel.

672. _____. 1972. The fall migration: middle Atlantic coast region. Am. Birds 26(1):41-45.

A kill of 200 birds occurred at a Lynchburg, Va. TV tower on 24 September 1971.

673. _____. 1974. The fall migration: middle Atlantic coast region. Am. Birds 28(1):33-37.

A kill of 180 birds, mostly warblers, occurred at a Baltimore, Md. tower on 28-29 September 1973.

674. Scott, R. E., L. J. Roberts, and C. J. Cadbury. 1972. Bird deaths from power lines at Dungeness. Br. Birds 65(7):273-286.

Bird mortality was monitored from January 1964 to November 1970 along a section of power line in an area heavily used by migrants. Of the 1285 birds (74 species) collected, Starlings (489) and gulls (138) suffered the heaviest losses, followed by various nocturnal migrants (rails, Turtle Doves, thrushes, warblers). Few diurnal migrants were found. Many corpses were lost to scavengers, and the kill may actually have exceeded 6000. Attempts to make the wires more visible, thus reducing mortality, with luminous orange tape were inconclusive. A list of the casualties is given and the results of experiments to test the removal of dead birds by scavengers are presented. The kill at the power lines was similar in species composition to that at a lighthouse. The siting of power lines is a critical factor in the amount of mortality at a given location, and other factors such as height of migration and flock configuration are important in determining which species are killed.

675. Seets, J. W., and H. D. Bohlen. 1977. Comparative mortality of birds at television towers in central Illinois. Wilson Bull. 89(3):422-433.

From August to December 1972, seven towers ranging from 185 to 484 m tall were checked for dead birds on mornings following nights of fog or overcast. A total of 5465 birds of 79 species was collected, with 60% of the losses occurring on the night of 26-27 September. Most birds were killed on nights with cloud ceilings of 550 m or less. There was "no consistent relationship between tower height, terrain, or tower location and number of birds killed . . . ." It is believed that the number of birds killed on a given night is dependent on local weather conditions and the number of birds aloft.

676. Serr, E. M. 1976. The spring migration: northern Great Plains. Am. Birds 30(4):855-858.

Mention is made of a "wire-killed" Peregrine Falcon in Montana.

677. Sharp, B. 1971. Heavy mortality of migrating birds at Madison's TV towers. Passenger Pigeon 33(4):203-204.

On the night of 23-24 September 1968, 493 birds of 33 species were killed at four Madison, Wis. towers. Weather data and kill lists are given. Thrushes, warblers, and vireos comprised 98% of the losses.

678. Siegfried, W. R. 1972. Ruddy Ducks colliding with wires. Wilson Bull. 84(4):486-487.

The following birds were found dead near overhead wires at Minnedosa, Manitoba: eight Ruddy Ducks, four American Coots, two Blue-winged Teal, one Mallard, and one Pintail. Male Ruddy Ducks seem particularly susceptible to such accidents because they fly low when moving from pond to pond and they normally fly only at dusk on the breeding grounds.

679. Simison, R. L. 1973. Some natural enemies join forces to curb electrocution of eagles. Wall Street Journal, 11 July, 89(7):1,12.

The efforts of power companies, conservation groups, and government agencies to reduce the electrocution hazard to eagles are described. Research, including the use of a trained one-year old Golden Eagle, has resulted in design changes that have made formerly dangerous poles safe (Nelson 1975, Nelson and Nelson 1976).

680. Sincock, J. L., and G. E. Swedberg. 1969. Rediscovery of the nesting grounds of Newell's Manx Shearwater (Puffinus puffinus newelli), with initial observations. Condor 71(1):69-71.

In Hawaii, the Newell's Shearwater, or Ao, frequently is attracted to lighted highways, parks, football fields, and buildings.

681. Sinner, P. F., II. 1972. Window kill research project. Valley City State College, Valley City, N. Dak. Unpub. rep. 7 pp.

Of 28 birds that died by flying into windows in Valley City between 25 March and 19 May, 16 were Slate-colored (Dark-eyed) Juncos. Most losses occurred at undraped, recently washed windows.

682. Sisson, J. 1975. Death trap. Natl. Wildl. 13(2):18.

In 15 years, 30 Mute Swan died by striking power lines in a Michigan village.

683. Small, A. 1958. Fall migration: southern Pacific coast region. Audubon Field Notes 12(1):57-60.

The author states: "As contrasted with the eastern portion of the continent 'collision' recoveries from lighted towers, power lines, airport ceilometers, etc. are virtually unknown and/or unreported in this Region." (Squires and Hanson 1918).

684. Smith, D. G., and J. R. Murphy. 1972. Unusual causes of raptor mortality. Raptor Res. 6(2):4-5.

Several instances of eagles being electrocuted by power lines are discussed.

685. Smith, (Mrs.) E. D., and (Mrs.) R. C. Tedards. 1962. Tower casualties at Columbia, South Carolina in 1961. Chat 26(2):43-45.

Favorable weather conditions during fall 1961 produced only light casualties at the WIS tower. From 20 September to 30 November, 76 birds of 30 species were found dead, 59 of those (mostly sparrows) on 7 November. A complete list of the casualties by date of collection is given, with weather data, weight, sex, age and fat condition of each bird.

686. Smith, L. B. 1966. Bird mortality at radio and TV towers near Winnipeg, September 1965. Blue Jay 24(4):172-176.

Mortality at four towers on 23 September totalled 184 birds of 35 species. At the CJAY tower, 91 birds of 22 species and 146 of 27 species were recovered on 29 September and 1 October, respectively. Weather conditions and kill lists are given.

687. Snow, C. 1973a. Habitat management series for endangered species, report number 5: Southern Bald Eagle Haliaeetus leucocephalus leucocephalus and Northern Bald Eagle Haliaeetus leucocephalus alascanus. Bur. Land Manage. Tech. Note T-N-171. 58 pp.

Causes of mortality among Bald Eagles include electrocutions, but insufficient data are available to determine the impact of electrocutions on Bald Eagle populations. It is a minor factor compared to shooting, but losses in some areas may be considerable.

688. _____. 1973b. Habitat management series for unique or endangered species, report number 7: Golden Eagle, Aquila chrysaetos. Bur. Land Manage. Tech. Note T-N-239. 52 pp.

Electrocutions and collisions with power lines appear to be fairly common, particularly among juveniles. Three phase, four carrier lines with less than six feet between phase conductors have been particularly lethal. Electrocution is a major mortality factor in some areas (Boeker and Nickerson 1975).

689. Snyder, L. L. 1946. "Tunnel fliers" and window fatalities. Condor 48(6):278.

Ovenbirds, thrushes and other birds that "habitually make swift flights through restricted passages in heavy cover" are probably guided in their flights by a view of the light ahead of them. These species are among the most commonly killed by striking windows (Ross 1946 and Willet 1945).

690. Somerset, H. 1972. Jabiru killed by power line. S. Aust. Ornithol. 26(3):55.

A Black-necked Stork was found dead beneath a power line near Darwin in November 1971.

691. Sowls, L. K. 1955. Prairie ducks - a study of their behavior, ecology and management. The Stackpole Co., Harrisburg, Pa. and the Wildl. Manage. Inst., Washington, D.C. 193 pp.

In the Delta Marsh, Manitoba, four of seven duck drakes and four American Coots found dead during 1946-50 had apparently struck telephone wires.

692. Spinney, H. L. 1902. Seguin Light Station, Me. J. Maine Ornithol. Soc. 4:43-45.

The night of 5 October 1900 was foggy until 2000 when it cleared and many birds were seen "gyrating" around the light. In the morning, 275 birds were collected.

693. _____. 1903. Extracts from the journal of Capt. Herbert L. Spinney, 1st keeper Seguin Island Light, Maine. J. Maine Ornithol. Soc. 5:52-58.

These extracts deal with bird mortality at this light, "one of the most powerful ones in existence", during 1893-1902. Robins, an Osprey, and Leach's Petrels were among the many species observed at the light at night. On two occasions, the sky that had been cloudy cleared, and birds that had been at the light, left.

694. Spofford, W. R. 1949a. The accident to migrating birds at the Nashville airport. Migrant 20(1):9-12.

About 300 birds of 33 species were killed in the early morning of 10 September 1948 at the Nashville, Tenn. ceilometer. Included among the casualties were 95 Red-eyed Vireos. The cloud ceiling registered 4000 feet at the time of the accident. The birds probably were blinded by the bright beam of light and crashed into the ground. This is apparently the first reported kill at a ceilometer.

695. _____. 1949b. Mortality of birds at the ceilometer of the Nashville airport. Wilson Bull. 61(2):86-90.

The same incident as that reported in Spofford 1949a is described. The author concludes that "the birds did not fly either into the light or into the ground, but were arrested high in the air, to fall to the ground with death by impact."

696. Sprunt, A., IV. 1972. The Bald Eagle. Pages 97-103 in Proc. Symp. on Rare and Endangered Wildl. of the Southwest United States.

Electrocution is a problem in the west, particularly at older transmission lines. Golden Eagles are more affected than Bald, but both species are involved in significant numbers.

697. Squires, W. A., and H. E. Hanson. 1918. The destruction of birds at the lighthouses on the coast of California. Condor 20(1):6-10.

Lighthouses on the California coast reported very slight losses in general. The few kills that were reported involved shorebirds and waterfowl almost entirely. The lack of landbirds in kills was attributed to: (1) the migration of landbirds does not occur in waves as in the eastern U.S., (2) lighthouses are built lower in California than in other locales, and (3) the migration doesn't follow the coast line as it does on the Atlantic coast. Most losses occurred on dark, overcast nights. Larger birds such as ducks and grebes simply crashed into the structures, whereas the smaller landbirds became confused by the lights and flew around until they dropped to the ground exhausted.

698. Stahlecker, D. W. 1975. Impacts of a 230 kV transmission line on Great Plains wildlife. M.S. Thesis. Colorado State Univ. Ft. Collins. 67 pp.

Wildlife censuses were conducted between 10 September 1973 and 9 August 1975 along a 230 kV transmission line in southeastern Colorado before, during, and after its construction. Avian mortality due to collisions with the transmission line and ground wire was slight - one Mourning Dove and five Horned Larks. But because other birds may have fallen on parts of the right of way that weren't searched and the impact of scavengers was not assessed, losses may have been greater.

699. Steele, J. H. 1903. The city hall list for 1903. Cassinia 7:78.

At the Philadelphia, Pa. city hall, 18 birds of 11 species were killed during fall 1903.

700. Stevenson, H. M. 1956a. Fall migration: Florida region. Audubon Field Notes 10(1): 18-22.

Over 2000 birds were killed on 8-9 October 1955 at a new 660-foot tower near Tallahassee in Leon Co. This marked the beginning of the long term study of bird losses at the WCTV tower by Stoddard (1962), Stoddard and Norris (1967), and Crawford (1974).

701. _____. 1956b. Spring season: Florida region. Audubon Field Notes 10(4):325-329.

Unusual migration records from the kill at the WCTV tower, Tallahassee are mentioned.

702. _____. 1957. Fall migration: Florida region. Audubon Field Notes 11(1):18-22.

The October 1956 kill at the WCTV tower was less than in 1955.

703. _____. 1958a. Fall migration: Florida region. Audubon Field Notes 12(1):21-26.

On 4-5 October 1957, 2000 birds were killed at the WCTV tower near Tallahassee, and 700-800 died at towers in Jacksonville.

704. _____. 1958b. Spring migration: Florida region. Audubon Field Notes 12(4):344-348.

Kills were reported on 4 April (228 birds) and 11 April (220) at WCTV, Tallahassee, and on 21 April (297) at Jacksonville. The composition of the kills was very dissimilar between locations. There was poor correspondence between the species composition of the kills and field observations of migrants.

705. _____. 1959a. Fall migration: Florida region. Audubon Field Notes 13(1):21-25.

In fall 1958, 1149 birds died at the WCTV tower, Tallahassee.

706. _____. 1959b. The spring migration: Florida region. Audubon Field Notes 13(4):363-365.

Relatively low seasonal kill totals of 307 and 61 were recorded for the WCTV and Jacksonville towers, respectively.

707. _____. 1960a. Fall migration: Florida region. Audubon Field Notes 14(1):25-29.

Fall 1959 mortality at the WCTV tower is mentioned.

708. _____. 1960b. Spring migration: Florida region. Audubon Field Notes 14(4):379-383.

Over 1800 birds were killed at the WCTV tower, Tallahassee during late April and early May. Jacksonville reported 300 Ovenbirds killed on a single night. There was no correspondence between the tower kills and field surveys of migrants in species composition.

709. _____. 1962. Fall migration: Florida region. Audubon Field Notes 16(1):21-25.

During fall 1961, 1212 birds were found dead at the WCTV tower near Tallahassee. On 17 September, 1100-1200 birds died at the Jacksonville towers.

710. _____. 1963a. Fall migration: Florida region. Audubon Field Notes 17(1):24-28.

During fall 1962, the monthly kill totals at WCTV, Tallahassee were 1264 (September), 291 (October), and 288 (November).

711. _____. 1963b. Spring migration: Florida region. Audubon Field Notes 17(4):397-399.

A record 87 birds were killed in May at the WCTV tower Tallahassee.

712. _____. 1964. Winter season: Florida region. Audubon Field Notes 18(3):346-351.

TV tower mortality was generally not heavy, but 64 birds were killed at the WCTV tower, Tallahassee on the early date of 15 March.

713. _____. 1965. Winter season: Florida region. Audubon Field Notes 19(3):370-374.

The highest ever March kill, 709 birds, was recorded at the WCTV tower in 1965. Of the losses, 335 were Yellow-rumped Warblers killed on 12 March.

714. _____. 1966. Fall migration: Florida region. Audubon Field Notes 20(1):30-35.

The largest November kill ever at WCTV, 770 birds, was recorded in 1965. November kills generally consist of wintering species.

715. _____. 1967a. Fall migration: Florida region. Audubon Field Notes 21(1):22-25.

November 1966 mortality at the WCTV tower near Tallahassee is mentioned briefly.

716. _____. 1967b. Spring migration: Florida region. Audubon Field Notes 21(4):497-500.

Migration records from kills at the WCTV tower are mentioned.

717. _____. 1973. The fall migration: Florida region. Am. Birds 27(1):45-49.

In early October 1972, 193 birds of 39 species were killed at the WCTV tower, Tallahassee, and about 1000 birds died at Jacksonville.

718. _____. 1976. The winter season: Florida region. Am. Birds 30(3):708-711.

In March 1976, 56 birds died at the WCTV tower.

719. _____. 1977. The winter season: Florida region. Am. Birds 31(1):322-325.

Reference is made to a December 1976 casualty at the WCTV tower.

720. Stewart, (Mrs.) J. 1976. Bird kill at smoke stack. Redstart 43(2):73-74.

On 30 September 1973, approximately 2000 birds (mostly warblers and vireos) were killed at a 1103-foot smoke stack of a power plant at Cheshire, Ohio. The stack was not floodlit. Weather was rainy and foggy. Also listed are smaller kills from 5, 6, and 7 October bringing the total species count to 33.

721. Stewart, P. A. 1973. Electrocution of birds by an electric fence. Wilson Bull. 85(4): 476-477.

The death of a Screech Owl is reported at an electric fence that is estimated to electrocute up to 200 birds annually in North Carolina.

722. Stoddard, H. L., Sr. 1962. Bird casualties at a Leon County, Florida TV tower, 1955-1961. Tall Timbers Res. Sta. Bull. No. 1. 94 pp.

This exemplary work documents almost daily, year-round collections of casualties at the WCTV towers. (A 673-foot tower built in 1955 was replaced in April 1960 with a 1010-foot tower.) About 17,000 birds (150 species) were collected, mostly in the fall months. In addition to a summary of the kill by species, weather conditions are discussed and the problems caused by scavengers/predators, particularly Great Horned Owls, are outlined.

723. Stoddard, H. L., Sr., and R. A. Norris. 1967. Bird casualties at a Leon County, Florida TV tower: an eleven-year study. Tall Timbers Res. Sta. Bull. No. 8. 104 pp.

In this report, the study begun by Stoddard in 1955 is updated through 30 September 1966. In the 11 years, over 29,000 birds of 170 species were collected. Although most losses were in the fall, spring kills seemed to be composed of species that breed abundantly in that area. (Avery et al. 1978 found a similar trend in North Dakota tower losses.) Dangerous weather may cause differential mortality among species, sexes, and age classes as each group peaks at a different time. (See Crawford 1974 for results of continued monitoring of the WCTV tower.)

724. Stone, W. 1906. Some light on night migration. Auk 23(3):249-252.

At a large lumber yard fire in Philadelphia, the author observed the passage of spring migrants illuminated by the light from the fire. The birds did not seem to change direction in response to the blaze, but may have been drawn down from higher altitudes. About 30 birds, including juncos and Song Sparrows, were burned to death as they passed too close to the fire.

725. Stout, I. J. 1967. The nature and pattern of nonhunting mortality in fledged North American waterfowl. M.S. Thesis. Virginia Polytechnic Inst., Blacksburg, Va. 329 pp.

Collisional factors including towers and power lines were among the causes of mortality considered. A questionnaire survey, band returns, and a survey of published and unpublished reports were the sources of the data. It is observed that "the various utility wires . . . do cause substantial waterfowl mortality", but towers aren't as great a hazard. Of mortality reported in the surveyed literature, 65% of the collisional losses were due to wire strikes and 4% to towers. Most losses to wires occurred during fall migration in inclement weather.

726. Stout, I. J., and G. W. Cornwell. 1976. Nonhunting mortality of fledged North American waterfowl. J. Wildl. Manage. 40(4):681-693.

Over 2 million cases of reported nonhunting mortality during 1930-64 were analyzed. Collisional mortality, including towers and power lines, accounted for 0.1% of the deaths (3015 incidents), and was most common in the Central Flyway.

727. Street, T. E. 1954. The ceilometer hazard. Chat 18(2):56-57.

Birds were first observed around the Greensboro-High Point, N.C. ceilometer on 15 September 1948, but no losses were recorded until 17 September 1953 when 16 birds of four species were found dead.

728. Strnad, F. 1962. Birds killed at the KROC-TV tower, Ostrander, Minnesota. Flicker 34(1):7-9.

Five kills during September and October 1961 totalled over 2000 birds of 66 species at this 1314-foot tower. On 3-4 September, 526 birds were collected out of an estimated 1500-2000 killed. Overcast conditions prevailed during the incidents.

729. _____. 1975. More bird kills at KROC-TV tower, Ostrander, Minnesota. Loon 47(1):16-21.

The author summarizes previous mortality at this tower (Strnad 1962 and Feehan 1963) and adds findings from the autumns of 1972 (185 birds, 32 species), 1973 (726, 59), and 1974 (801, 38). Complete kill lists from 1961, 1962 and the present study are given. Among the 3507 casualties (84 species) listed, Northern Waterthrushes (619) and Red-eyed Vireos (516) were the most common. A description of the 1300-foot tower, its lights and guy wires is given, and details of the method of search and the weather conditions on kill nights are also provided.

730. Stroncek, L. H. 1978. Fences take toll. Colo. Outdoors 27(2):47.

Photographs of a Great Blue Heron and a Cinnamon Teal killed on fences are included.

731. Stuart-Sutherland, R. 1922. Round the lamp. Emu 22(1):54-59.

Mortality of petrels and other birds occurred regularly at the 180-foot lighthouse at Puysegur Point, New Zealand. The birds were "absolutely powerless to resist the attraction" of the light. Most birds suffered broken wings, legs or necks rather than head injuries. Observations of bird behavior at the light are presented, and an annotated list of species seen at the light from March 1919 to January 1922 is given.

732. Swales, M. K. 1965. The sea-birds of Gough Island. Ibis 107(1):17-42 and 107(2):215-229.

On this south Atlantic island, thousands of albatrosses swarmed around 750-watt lights, especially on nights with low clouds or fog and little wind. One albatross crashed into a light. Storm-petrels were also attracted, but did not approach as close as the albatrosses.

733. Swenk, M. H. 1922. An unusual mortality among migratory Lapland Longspurs in northwestern Nebraska. Wilson Bull. 34(2):118-119.

A snowstorm resulted in large-scale mortality with many losses resulting from collisions with buildings, trees and lights.

734. Swirski, Z. 1965. Bird migrations. U.S. Dep. Commerce, Off. Tech. Serv., Washington, D.C. 104 pp. [Translated from "Wedrowki ptakow".]

Bird losses at lighthouses are mentioned. Mortality was reduced when lighthouses were floodlit.

735. Szczepski, J. B. 1965. Palace of Culture and Science in Warsaw again a locality of bird tragedy [in Polish, English summary]. Przegl. Zool. 9(2):178-184.

On 2 September 1957, at about 2200, hundreds of migrants struck the Palace of Culture and Science, the tallest building in Warsaw (231 m). Low clouds obscured the top of the building and no doubt was responsible for the accident. Of 453 casualties collected, 435 (96%) were Pied Flycatchers (Ficedula hypoleuca). (From English summary.)

736. Tanner, J. T. 1954. Bird mortality during night migration, October 1954. Migrant 25(4):57-59.

This is a general summary of the widespread mortality that occurred in the eastern U.S. on the nights of 6-7 and 7-8 October 1954. Special emphasis is placed on weather factors accompanying the losses. (See Chamberlain 1954, Johnston 1955, and Laskey 1954 for details of losses in the southeastern U.S.)

737. Tate, J., Jr. 1962. Meadowlark killed by electric fence. Wilson Bull. 74(2):184.

One bird was killed in Illinois.

738. Taverner, J. H. 1969. Birds singing in lighthouse beams. Br. Birds 62:78-79.

Birds of several species sang full songs as hundreds of migrants swirled in the beams of a lighthouse. Comments by the editors and G. H. Evans following the article corroborate the author's observations.

739. Taylor, W. K. 1972. Analysis of Ovenbirds killed in central Florida. Bird-Banding 43(1): 15-19.

Age, sex, weight, and wing chord data from 740 Ovenbirds killed at the WDBO-TV tower in Orlando from fall 1969 through fall 1971 are presented.

740. _____. 1973. Black-throated Blue and Cape May Warblers killed in central Florida. Bird-Banding 44(4):258-266.

Age, sex, and weight data from 186 Black-throated Blue and 134 Cape May Warblers collected at the Orlando TV tower and at the Vehicle Assembly Building at Cape Kennedy are analyzed and related to probable migration routes. Adults were predominate inland during fall migration in both species.

741. _____. 1974. A new hybrid bunting (Passerina cyanea x Passerina ciris). Auk 91(3):485-487.

This specimen was among 61 migrants of 17 species found dead on 22 April 1971 at the Vehicle Assembly Building, Cape Kennedy, Fla.

742. _____. 1976. Migration of the Common Yellowthroat with an emphasis on Florida. Bird-Banding 47(4):319-332.

Data from 3420 fall migrants killed at towers in Orlando and Leon Co., Fla. are used in conjunction with other mortality incidents to analyze the migration pattern of this species.

743. Taylor, W. K., and B. H. Anderson. 1973. Nocturnal migrants killed at a central Florida TV tower; autumns 1969-1971. Wilson Bull. 85(1):42-51.

During the three fall seasons, 7782 birds of 82 species were killed at the 1481-foot WDBO tower near Orlando. The losses are listed by species in half-month intervals from August through December, and an annotated species list with sex and age information is given. One Florida yellow bat was also collected. Information on weather and lighting is included.

744. _____. 1974. Nocturnal migrants killed at a central Florida TV tower, autumn 1972. Fla. Field Nat. 2(2):40-43.

During the fourth season of monitoring losses at the Orlando tower, 1347 birds of 49 species were collected, 89% of them warblers. The 4-year total losses were 9130 birds of 89 species. A kill list for fall 1972 is provided by half-month periods. This tower collapsed in June 1973.

745. Temme, M., W. B. Jackson, and W. A. Peterman. 1975. Davis-Besse bird hazard contract. Semi-annual rep. December:1-22.

Throughout the fall 1975 season, 155 dead birds (35 species) were recovered at the Toledo Edison Davis-Besse site; over 80% of the casualties were from the cooling tower. As in previous fall seasons (Williams and Jackson 1974, Williams et al. 1975a), warblers comprised the greatest proportion (57%) of the kill; kinglets (21%) and finches (10%) were also well represented. Scavengers, particularly skunks and racoons, removed 20% of the tagged carcasses during the first night. Internal examinations of 432 carcasses collected over the past three years showed hematoma in the brain case to be the most common injury. Crushed skulls, broken bills, and various bone fractures were also recorded. The three highest kill days were related to high pressure systems (northerly winds) west of Lake Erie. Conditions favorable for increased migration are those under which losses are likely to occur; high pressure and northerly winds are not sufficient of themselves for high mortality. These observations support the wave pattern of migration in which the bulk of the birds likely to strike a tall obstacle pass through the area during a short period of time. It is becoming possible to predict under what conditions high mortality is likely to occur. Strobe lights used for the first time on the cooling tower did not noticeably influence bird movements. A species kill list for fall 1975 and lists by family for the fall seasons 1972-75 are given. Weather data and the locations of carcasses at the site are also provided.

746. _____. 1976. Davis-Besse bird monitoring contract. Semi-annual rep. July:1-15.

From 14 April to 6 June 1976, 62 birds (31 species) were found dead at the cooling tower (69%), meteorological tower (18%) and other structures (13%) of the Davis-Besse power plant site. Warblers (55%), finches (11%), and kinglets (8%) comprised the majority of the losses. Among large birds examined, hematoma on the breast was prevalent, suggesting that for these birds impact usually occurs in that body area. Smaller birds suffered hematoma to the head as well as bill injuries and various bone fractures. From analyses of weather conditions and mortality, it is concluded that: spring mortality is related to the relative strengths of the prevailing weather systems, mortality is higher in fall than in spring, high bird mortality occurs only during a brief period in the spring, conditions most favorable for mortality are those when cold fronts are west or northwest of the site or when lows are over or just east of the site, and the greatest chance for spring losses is when a cold front lies through Lake Erie parallel to the north and south shores. A species kill list for spring 1976 and a list by family for springs 1975 and 1976 are provided. Age composition of warblers, vireos and kinglets for the fall 1972-75 losses is presented as is a listing of all of the injuries noted during autopsies of 617 spring casualties. Weather data and the locations of carcasses at the site are included.

747. Terres, J. K. 1956a. Death in the night. Audubon Mag. 58(1):18-20.

A general summary of the widespread bird losses in the eastern U.S. during early October 1954 (Tanner 1954) is followed by a description of the author's efforts to reduce losses at airport ceilometers through the use of filters. At Nashville, Tenn., a filter that passes only utraviolet light was installed on the ceilometer in October 1955 and apparently eliminated losses there. (See Spofford 1949a, b and Laskey 1951 and 1954 for reports of mortality before the installation of the filter.) Following the article, on pages 52 and 56, are letters relating to this problem and the use of filters to eliminate it. (See Velie 1963 for additional discussion.)

748. _____. 1956b. Migration records of the Red Bat, Lasiurus borealis. J. Mammal. 37(3):442.

Among the casualties at the Empire State Building were two red bats on 18 October 1955 (156 birds, 18 species) and four on 5 October 1954 (123 birds, 28 species).

749. Teulings, R. P. 1971a. The fall migration: southern Atlantic coast region. Am. Birds 25(1):40-44.

In fall 1970, six kills, totalling nearly 2000 casualties, were reported from Raleigh, Chapel Hill, and Bladen Co., N.C. and Atlanta, Ga. (See Bagg 1971 for kill lists.)

750. _____. 1971b. The spring migration: southern Atlantic coast region. Am. Birds 25(4): 719-723.

Over 200 casualties were collected during the spring at the Equitable Building, Atlanta, Ga. Eighteen of the 40 species represented were warblers. (See French 1973 for details.)

751. _____. 1972a. The fall migration: southern Atlantic coast region. Am. Birds 26(1): 45-50.

Two towers were checked regularly for casualties during fall 1971. The 1960-foot WECT tower at Bladen Co., N.C. totalled 1706 dead birds of 75 species, and the 1250-foot WWAY tower at Boiling Springs, N.C. accounted for 970, 958 on the night of 3-4 October. Partial kill lists and unusual records are given for the seven largest single-night kills. Warblers predominated overall.

752. _____. 1972b. The spring migration: southern Atlantic coast region. Am. Birds 26(4): 748-751.

A kill at an Atlanta, Ga. building is mentioned.

753. _____. 1974. The fall migration: southern Atlantic coast region. Am. Birds 28(1):37-40.

A major kill consisting of about 600 casualties was reported from the WECT tower in Bladen Co., N.C. on the night of 30 September-1 October 1973.

754. _____. 1975. The fall migration: southern Atlantic coast region. Am. Birds 29(1):40-43.

An estimated 4000 birds were killed on the night of 4-5 September 1974 at a Bladen Co., N.C. tower.

755. Thill, J. F. 1972. The month. Prothonotary 38(10):116.

In September 1972, "remarkably light" kills were reported from towers in the Buffalo, N.Y. area.

756. _____. 1973. The month. Prothonotary 39(10):117.

On 6 September, 44 birds of 14 species were killed or injured at the WGR and WKBW TV towers near Buffalo, N.Y. On 28 September, 104 birds of 36 species were collected at the same two towers, and 15 birds, mostly Yellow-bellied Sapsuckers, were found dead at a building in downtown Buffalo.

757. _____. 1974a. The month. Prothonotary 40(9):94-95.

In August, there were frequent reports of bird kills at towers and "other electronic beacons". No details are given.

758. _____. 1974b. (Untitled). Prothonotary 40(10):106.

In September, heavy bird mortality at Buffalo, N.Y. towers followed the passages of cold fronts on the 14th, 22-23rd, and 30th. No details are given.

759. _____. 1975. The month. Prothonotary 41(10):124-125.

In September, major kills occurred at towers in elevated areas of southern Erie Co., N.Y. All kills took place on cloudy, overcast nights. No details are given.

760. _____. 1976. The month. Prothonotary 42(10):122.

"Because of a happy combination of favorable winds and clear nights, television tower kills of migrating passerine species were remarkably light during September."

761. Thomas, C. B. 1977. The mortality of Yorkshire Canada Geese. Wildfowl 28:35-47.

Of the 587 ringed Canada Geese recovered since 1967 in Yorkshire, England, information on cause of death was available for 552; 4.3% of these hit overhead wires.

762. Thompson, L. S. 1977. Overhead transmission lines: impact on wildlife. Mont. Dep. Nat. Resourc. and Conserv., Energy Planning Div., Res. Rep. No. 2. 51 pp.

"This report provides an overview of the potential impacts of transmission lines upon wildlife, and suggestions on how impacts of new lines may be prevented or mitigated." Among the topics addressed are bird losses due to strikes and electrocutions at power lines. An extensive bibliography is included.

763. _____. 1978. Transmission line wire strikes: mitigation through engineering design and habitat modification. Pages 27-52 in M.L. Avery, ed. Impacts of transmission lines on birds in flight. U.S. Fish Wildl. Serv. FWS/OBS-78/48.

This is an extensive treatment of the means by which bird strikes may be reduced through design changes on utility poles and towers and through transmission line siting considerations.

764. Thomson, A. L. 1926. Problems of bird-migration. Houghton Mifflin Co., Boston. 350 pp.

Bird mortality and behavior at lighthouses is mentioned briefly in Chapter 3.

765. Ticehurst, C. B. 1916. Notes on migrants and moult, with special reference to the moults of some of our summer visitants. Scott. Nat. 50:29-38.

The birds examined were obtained in part from kills at lighthouses on the Isle of Wight and elsewhere.

766. Tomkins, I. R. 1963. Fall migration: southern Atlantic coast region. Audubon Field Notes 17(1):22-24.

At Aiken, S.C., 400 birds of 32 species (mostly Red-eyed Vireos) were found dead at a tower on 7 September 1962 (Post 1963) and 1602 birds were collected on 7 and 8 September at a tower in Charleston, S.C. where Red-eyed Vireos, Ovenbirds, and American Redstarts comprised 91% of the kill.

767. Tordoff, H. B., and R. M. Mengel. 1956. Studies of birds killed in nocturnal migration. Univ. Kans. Publ. Mus. Nat. Hist. 10(1):1-44.

This is an extensive analysis of 1090 birds of 61 species killed at the 950-foot WIBW TV tower in Topeka, Kansas during fall 1954. The losses are listed by date collected, and an annotated species list gives weights, fat conditions, and sex-age data. The kill was "not at all random" with respect to the actual relative abundance of species, since some birds (e.g., shorebirds) were common in the field, but uncommon in the kill. However, an estimate is made of the volume of migration through the area by assuming the tower took a random sample of the overall migrant population. Differential migration by sex and age is discussed in certain species as are differences in wing length, tail length, and weight.

768. Townsend, C. W. 1931. Tragedies among Yellow-billed Cuckoos. Auk 48(4):602.

Five birds were killed by flying into windows in Massachusetts.

769. Trauger, D. L., A. Dzubin, and J. P. Ryder. 1971. White geese intermediate between Ross' Geese and Lesser Snow Geese. Auk 88(4):856-875.

A mention is made of 131 Lesser Snow and Blue Geese that struck a power line near Craig, Mo. in March 1966. No details are given.

770. Trembly, C. C. 1889. Northern Phalarope. Oologist 6(10):236.

Several Northern Phalaropes were found dead below a 110-foot electric light tower in Utica, N.Y.

771. Trimm, H. W. 1956. Birds and the cyclometer. N. Y. State Conserv. 11(3):36.

On the rainy night of 17 September 1956, about 200 birds of 25 species were killed at an Albany, N.Y. ceilometer. A kill list is given. This was also published in the Bulletin of the Audubon Society of Rhode Island 18(3):37-38, which was our source for this citation.

772. Trott, J. 1957. TV tower fatalities at Chapel Hill. Chat 21(1):28.

As estimated 2500 birds of 44 species were killed on 28 September and 3 October at a 788-foot tower in North Carolina. Low cloud ceilings accompanied the incidents. A kill list is given.

773. Tufts, R. W. 1928. A report concerning destruction of bird life at lighthouses on the Atlantic coast. Can. Field-Nat. 42:167-172.

In a survey of lighthouses in the maritime Canadian provinces and Newfoundland, 152 keepers reported no mortality and 45 reported some losses. Of the former group, 131 had fixed lights and 21 were flashing or revolving. The lights reporting some mortality were roughly half fixed and half flashing. One report stated that losses decreased 99% after the original fixed light was replaced with a revolving one. Generally, losses were reported to be associated with rainy or foggy nights, although one report of about 1000 casualties on a clear night was obtained. The accounts from all of the lights reporting losses are summarized.

774. Turner, J. 1971. Eagles: vanishing Americans? Sierra Club Bull. 56(9):14-19.

Illegal shooting, poisoning, and power line electrocutions cause considerable eagle mortality in western states. Sixteen eagle deaths were attributed to power lines near Worland, Wyo. in 1971. In the Escalente Desert, Utah, forty dead eagles (10 with "white heads") were found beneath a 12-mile stretch of power line. An additional 54 eagles were reported killed by power lines in Colorado's Pawnee National Grasslands and Moffat County. Eagles using utility wires and poles as perch sites are sometimes shot.

775. Ulrich, A. E. 1970. Report of the October 11th, 1970 bird count. Prothonotary 36(11): 139-144.

Included are tower kill lists for that date from three Buffalo, N.Y. area towers. A total of 524 birds was collected, and 20 of the 46 species represented were warblers. Yellow-rumped (105) and Black-throated Blue Warblers (63) were the most abundant species.

776. United States Department of the Interior. 1976. Conserving our fish and wildlife heritage. U.S. Fish Wildl. Serv. Ann. Rep. FY 1976. 221 pp.

Electrocutions of raptors at power lines in the western U.S. are being reduced in a cooperative program involving utility companies and private and governmental wildlife conservation agencies (Boeker and Nickerson 1975, Nelson 1975, Simison 1973).

777. Valum, B. 1968. Fugledod mot glassvegger [in Norwegian, English summary]. Sterna 8:15-20.

Bird mortality due to striking large glass windows is becoming a serious problem in Europe, and reports of such incidents from Norway are urged. Making the glass visible in some way reduces or eliminates the hazard. (From English summary.)

778. Velie, E. D. 1963. Report of a survey of bird casualties at television towers, ceilometers, and other obstructions. Flicker 35(3):79-84.

Reports of 51 incidents of bird mortality are tabulated, giving location, date, size of kill, and weather conditions. Included is a letter from the U.S. Weather Bureau stating that airport ceilometers are no longer a hazard to migrating birds because (1) most airports now use rotating-beam ceilometers and (2) the remaining fixed-beam ceilometers are being equipped with filters that eliminate visible wavelengths, permitting only ultraviolet to pass through. (See Terres 1956a for additional discussion.)

779. Verheijen, F. J. 1958. The mechanisms of the trapping effect of artificial light sources upon animals. Arch. Neer. Zool. 13:1-107.

A brief discussion of bird losses at lighthouses is included.

780. Vessey, S. H., and T. W. Scott. 1974. III. Loss of bird mortalities at the cooling tower. Bird hazard monitoring contract, Davis-Besse site. Semi-annual rep. June:21-23.

Scavenger activity at the site of Toledo Edison's Davis-Besse power plant near Port Clinton, Ohio was examined by monitoring the disappearance of tagged bird carcasses placed around the cooling tower. Of 35 carcasses put out, 8 (23%) were taken, indicating that the actual mortality (Williams and Jackson 1974) may have been higher than was recorded.

781. von Bloeker, J. C. 1927. Farallon cormorant killed by unusual accident. Auk 44(3):416.

In San Diego, Calif., a Double-crested Cormorant was picked up beneath a telephone wire following a severe storm. A mark on the bird's neck indicated that it had struck the wire.

782. Voronin, R. N. 1976. The mortality coefficient in populations of the Willow Grouse of the Bol'shezemel'skaya Tundra [in Russian]. Ekologiya 5:95-87.

The mortality of the Willow Ptarmigan was studied in this Russian area during 1969-75. Many birds were killed each year during migration through collisions with telephone wires and by hunting. (Citation and summary from Biol. Abstr. 65(3):1370.)

783. Vosburgh, J. 1966. Deathtraps in the flyways. Pages 364-371 in A. Stefferud, ed. Birds in our lives. U.S. Dep. Inter., Washington, D.C. 561 pp.

Mortality of migrants at towers and tall buildings is reviewed. The work of Kemper, Stoddard, Velie and others is discussed.

784. Walker, A. 1916. Some raptores [sic] of Douglas County, South Dakota. Condor 18(3):130.

A Golden Eagle was killed by flying into a wire fence near Delmont, S. Dak. on 11 November 1911.

785. Walkinshaw, L. H. 1956. Sandhill Cranes killed by flying into power line. Wilson Bull. 68(4):325-326.

In Nebraska, along the North Platte River, five cranes were found dead beneath 30-foot high power lines on the morning of 22 March 1954. Apparently, they had flown into the lines earlier in the morning, before it was light.

786. Wall, E. 1919. California Black Rail at San Bernadino, California. Condor 21(6):238.

The bird, found dazed on 3 August, had probably struck an electric or telephone wire. It eventually died.

787. Wallace, G. J., and H. D. Mahan. 1975. An introduction to ornithology. Macmillian Publ. Co., New York. 3rd ed. 546 pp.

A brief discussion of the problem of bird strikes at towers, windows, and ceilometers is included.

788. Warren, B. H. 1890. Report on the birds of Pennsylvania. E. K. Myers, Harrisburg, Pa. 534 pp.

On pages 400 and 401, a list of birds that struck the Absecon lighthouse, Atlantic City, N.J. during the period 22 August - 30 November 1889 is given.

789. Wayne, A. T. 1925. A late autumnal record for the Bachman's Warbler (Vermivora bachmani). Wilson Bull. 37(1):41.

The bird struck the lighthouse on Tybee Island, Ga. on 23 September 1924.

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790. Weaver, D. K., and R. St. Ores. 1974. Trumpeter Swan mortality. Proc. Pap. Trumpeter Swan Soc. Conf. 3:86-89.

Collisions with fences and telephone and power lines caused the deaths of 14 swan at four refuges and parks in the western and midwestern U.S. during 1958-73. This was 19% of the total recorded mortality.

791. Webster, F. S., Jr. 1960. Spring migration: south Texas region. Audubon Field Notes 14(4): 401-407.

Following the drizzly night of 1-2 May, many dead birds, mostly warblers, were found at an amusement park on southern Padre Island. Collisions with light poles or telephone wires probably was responsible for the deaths. (See James 1956 for more details.) At the University of Texas, Austin, birds are regularly seen milling around the illuminated Main Building, particularly on nights with low cloud ceiling. No deaths are mentioned.

792. _____. 1963. Fall migration: south Texas region. Audubon Field Notes 17(1):46-50.

In the early morning of 27 September 1962, at the Laughlin Air Force Base ceilometer, Del Rio, over 6000 birds were killed, including about 4200 Mourning Doves, 1 White-necked Raven, Upland Sandpipers, and Chuck-wills-widows. Ultraviolet or infrared radiation may have been involved in the mortality. There were indications that many birds struck the ground on their backs or at a 45° angle (Herndon 1962).

793. _____. 1965. Spring migration: south Texas region. Audubon Field Notes 19(4):490-497.

Cold fronts in mid-April grounded many migrants. Large numbers were killed by cars in Nueces, and numerous window kills were reported from the Corpus Christi area.

794. _____. 1973. The spring migration: south Texas region. Am. Birds 27(4):793-795.

On the overcast, misty night of 5-6 May, "hundreds, probably thousands, of passerines of great variety" swirled around the lights of a parking lot on Padre Island. Many exhausted birds were seen resting on the pavement, but no casualties were found.

795. Weed, C. M., and N. Dearborn. 1924. Birds in their relations to man. J. P. Lippincott Co., Philadelphia. 3rd ed. 414 pp.

Bird mortality due to striking lighthouses and telegraph and telephone wires is mentioned.

796. Weier, R. W. 1972. A probable instance of songbird collision mortality. Prairie Nat. 4(2):55-56.

On 23 May 1971, 68 birds of 9 species were picked up in a churchyard in Stanley, N. Dak. The mortality probably occurred during fog and drizzle the night before. The church is 30 feet tall and has a 30-foot unlighted bell tower.

797. Weir, D. N. 1971. Mortality of hawks and owls in Speyside. Bird Study 18(3):147-154.

Of 74 dead or seriously injured birds examined during 1964-69 in this British study, 33 suffered injuries through collisions with man-made obstacles, including overhead wires, windows, moving vehicles and trains.

798. Weir, R. D. 1972. Autumn migration kills at the Lennox generating station. Blue Bill 19(4):49-51.

During 12-19 September 1972, 3062 birds were found dead at the newly constructed 650-foot chimney of this power plant near Bath, Ont. Floodlights that had illuminated the structure were turned off on 20 September, and only 28 birds were killed thereafter. Of the 1531 birds killed on 19 September, 1515 were identified and a species list is given. Principal among the 49 species were Common Yellowthroats (361), Magnolia Warblers (227), and Bay-breasted Warblers (138). Difficulties in identifying the carcasses are mentioned.

799. _____. 1973a. Bird kills at the Lennox plant of the Ontario hydro-electric system, spring 1973. Blue Bill 20(2):23-24.

Throughout the season, 244 birds of 30 species were killed at the 650-foot chimney of the power plant near Bath, Ont.. Daily collections of casualties were made by plant personnel. Floodlights illuminating the structure were extinguished from late April to early June; a red obstruction light atop the chimney remained on as a warning to aircraft. Plans for fall 1973 call for the use of red filters on the floodlights and continued daily collection of dead birds. A kill list for the spring season is provided.

800. _____. 1973b. Bird kills at the Lennox generating plant, autumn 1973. Blue Bill 20(4): 55-57.

During the season, 697 birds of 43 species were collected at the 650-foot chimney of this Ontario power plant. Floodlights were turned off from 9 August to 10 October to help lessen the kill. Two red foxes took unknown numbers of dead birds before the daily collections were made. One little brown and one red bat were killed on 29 August. Most (94%) of the losses were warblers and vireos, with Magnolia (28%), Bay-breasted (11%), and Blackburnian Warblers (10%) the most common. The loss of only one Yellow-rumped Warbler was puzzling in that this species is by far the most common migrant warbler in the area. Large kills occurred in association with thunderstorms, fog, or haze. A list of casualties by date of collection and summaries of night flight call counts and weather conditions are given.

801. _____. 1974. Bird kills at the Lennox generating plant, spring and autumn 1974. Blue Bill 21(4):61-62.

Floodlights illuminating the 650-foot chimneys of the Ontario power plant were dimmed from 15 April to 8 June and from 9 August to 2 October, but kills still occurred, with 92 casualties in the spring and 1188 in the fall (35 species overall). Since the first chimney was built in fall 1972, 5288 birds have been killed. In 1974, 98% of the casualties were warblers and vireos, with Magnolia Warblers (33%) and Red-eyed Vireos (11%) the most common casualties. Large kills occurred on the clear nights of 13-14 (501 killed) and 14-15 September (508 killed). On both nights, winds were strong and flight call counts indicated that birds were flying lower than usual. Migrants were easily seen in the glow of city lights. A kill of 1524 birds at a new 1200-foot tower in Barrie, Ontario occurred on the weekend of 15 September (reported in the Toronto Globe and Mail on 10 October). Lists of casualties by date of collection and a summary of flight call counts and weather conditions are given.

802. _____. 1975. Bird kills at the Lennox generating plant- spring and autumn 1975. Blue Bill 22(4):47-48.

The spring and fall kill totals were 297 (36 species) and 324 (34 species), respectively. Warblers and vireos accounted for 86% of the 1975 total. The floodlights on the two chimneys were turned off during the periods 8 April to 13 June and 4 August to 2 October. The absence of stalled cold fronts during the fall probably accounted for the lack of large single-night kills. A complete list of casualties is given.

803. _____. 1976a. Bird kills at the Lennox generating plant- spring and autumn 1976. Blue Bill 23(4):41-43.

In 1976, 36 casualties of 8 species were collected in the spring and 327 of 37 species were recorded in the fall, including one red bat. As in previous years, floodlights on the chimneys were turned off during the periods of peak migration. Included is a complete list of casualties for 1976 and a brief discussion of the overall problem of birds colliding with man-made structures. Mention is made of the CN tower where kills continued despite the use of a new strobe light system designed to reduce bird strikes.

804. _____. 1976b. Annotated bibliography of bird kills at man-made obstacles: a review of the state of the art and solutions. Can. Wildl. Serv., Ont. Reg., Ottawa. 85 pp.

Included are 471 references, most of which are briefly annotated. The 28-page introduction summarizes what is known about bird migration and the effects of weather on migration and mortality, and reviews the literature on bird losses at lighthouses, ceilometers, floodlit obstacles, towers, tall buildings, and telephone and power lines. Also included is a table giving the number of TV towers of various heights throughout the U.S. The author concludes that, "Nocturnal bird kills are virtually certain wherever an obstacle extends into the air space where birds are flying in migration. The time of year, siting, height, lighting and cross sectional area of the obstacle and weather conditions will determine the magnitude of the kill."

805. _____. 1976c. Bird kills at the Lennox generating plant, spring and autumn 1975. Blue Heron 20(1):9-10.

The article by Weir 1975 is reprinted.

806. _____. 1977a. Summer season 1 June - 1 Sept., 1977. Blue Bill 24(3):33-35.

Kills occurred at the Lennox, Ont. power plant on nine dates in August, with 906 birds dying on the night of 23-24 August alone. Principal species killed were Blackburnian (158), Magnolia (113), Canada (75), and Bay-breasted (73) Warblers. During the night of the large kill, floodlights illuminating the chimneys were not turned off until 0117.

807. _____. 1977b. Bird kills at the Lennox generating station, spring and autumn 1977. Blue Bill 24(4):40-42.

For the sixth straight year, kills were reported at the chimneys of the Ontario Hydro plant at Bath, Ontario. The total of 2699 (61 species) casualties, of which 2575 were fall migrants, was the largest since the first chimney was constructed in 1972. Due to a change in the floodlighting procedures at the chimneys, the lights were inadvertently left on during nights of heavy migration and several large kills resulted. On 23 August, 908 birds were killed under overcast skies before the lights were extinguished at 0117. Similarly, 1172 birds died on the night of 19 September, during a driving rain. The lights weren't turned off until 0500. The sky was clear on the night of 12 September, but 259 birds were killed anyway before the lights were turned off at 0100 . After 19 September, the floodlights were not used, partly in response to the public reaction to the kills that were reported in the Toronto Globe and Mail. The system of not using the floodlights at all during the spring and fall migration periods was in force prior to 1977 and will be resumed beginning spring 1978. A complete list of casualties is provided, and the 11,230 casualties recorded since fall 1972 are totalled by season.

808. Weise, C. M. 1971. Relative abundance of small landbirds in southeastern Wisconsin. Passenger Pigeon 33(4):173-188.

Three mist net samples are compared with each other and with two tower-killed "samples" from Milwaukee, 1965-70, and Eau Claire, 1957 and 1963. The tower kills consisted almost entirely of warblers and vireos, and with regard to these two families, the mist net samples and the tower kills were in general agreement as to the relative abundance of species. Complete lists are given for the kills and for the mist net samples.

809. Welty, J. C. 1972. The life of birds. Alfred A. Knopf, New York. 546 pp.

The problem of bird losses at man-made structures is briefly mentioned.

810. West, A. H. 1954. Bird mortality- Chattanooga. Migrant 25(4):62-63.

On the night of 6-7 October 1954, 681 birds were found dead at the Chattanooga ceilometer. Some birds were found as far as 1500 feet from the light.

811. Westman, F. 1960. About casualties at the Barrie TV tower. Bull. Fed. Ont. Nat. 90:4-5.

During the period 20-27 September, which was characterized by hazy, drizzly weather, 936 birds of 45 species were found dead at the 708-foot Barrie, Ont. TV tower which sits atop a 250-foot hill. Most of the casualties were concentrated beneath guy wires. A list of the casualties is provided.

812. Weston, F. M. 1939a. The season: Pensacola (Fla.) region. Bird-Lore 41(1):54-55.

Over 40 birds of 12 species were found dead on the Pensacola Bay Bridge on 30 October 1938.

813. _____. 1939b. The season: Pensacola (Fla.) region. Bird-Lore 41 (suppl. 130):9-10.

No details are given, but many fewer birds were found dead on the Pensacola Bay Bridge in fall 1939 than in 1938.

814. _____. 1940. The season: Pensacola (Fla.) region. Bird-Lore 42 (suppl. 135):574-575.

In fall 1940, 25 birds of 10 species were found dead on the Pensacola bridge.

815. _____. 1944a. The season: Pensacola (Fla.) region. Audubon Mag. 46 (suppl. 147):6-7.

During the period 5-30 September 1943, 87 dead birds of 19 species were collected on the Pensacola bridge.

816. _____. 1944b. The season: Pensacola (Fla.) region. Audubon Mag. 46 (suppl. 148):70-71.

In October and November 1943, 37 dead birds of 15 species were found on the Pensacola bridge.

817. _____. 1948. Fall migration: Pensacola (Fla.) region. Audubon Field Notes 2(1):9-11.

No details are given, but the Pensacola bridge is said to have caused "many fall migration casualties" in recent years.

818. _____. 1965. A survey of the birdlife in northwestern Florida. Tall Timbers Res. Sta. Bull. No. 5. 147 pp.

From 1938 to 1949, the author collected a total of 740 dead birds of 75 species at the Pensacola Bay Bridge. Common Yellowthroats were the most numerous (136) among the casualties.

819. _____. 1966. Bird casualties on the Pensacola Bay Bridge (1938-1949). Florida Nat. 39(2):53-54.

Irregular checks of the bridge produced 740 dead birds of 75 species during the 12-year period. Kills occurred only in the fall. Power cables above the roadway of the bridge apparently were the cause of the mortality. The cables were removed in 1949, and a new bridge with well-lit structural parts proved no hazard to birds.

820. Wetmore, A. 1926a. The migration of birds. Harvard Univ. Press, Cambridge, Mass. 217 pp.

On pages 128-133, mortality at lighthouses is discussed; quotes from Brewster (1886) and Clarke (1912) are included.

821. _____. 1926b. Observations of the birds of Argentina, Paraguay, Uruguay, and Chile. U.S. Nat. Mus. Bull. No. 133. 448 pp.

On the night of 7 May 1921, the lights of a ship passing Lobos Afuera Island along the coast of Peru attracted Sooty Shearwaters, 40-50 of which landed on the vessel.

822. Wheeler, R. H. 1966. Sandhill Crane casualites in the blizzard of March 22, 1966. Nebr. Bird Rev. 34(4):69-70.

Some birds were killed during the stormy weather when they collided with power lines and trees.

823. Whelan, P. 1976. The bird killers. Ontario Nat. 16(4):14-16.

Known sites of bird mortality in Toronto are reviewed. These include 40 buildings and two towers, including the 1815-foot CN tower where 274 dead and injured birds were found on August and 92 were collected on 16 September. (This article was reprinted from the Toronto Globe and Mail, 17 September 1976.)

824. White, C. M. 1974. Current problems and techniques in raptor management and conservation. Trans. Thirty-ninth North Am. Wildl. Nat. Resourc. Conf. 39:301-312.

Electrocution of large raptors, particularly eagles, is regarded as a rather frequent problem in the western U.S. In Idaho, 22 Golden Eagles were found dead along 26 miles of power line, and 46 were killed along one segment of power line in Utah. Solutions to this hazard are being developed (Nelson 1975 and Miller et al. 1975).

825. Wiese, J. H. 1976. A study of the reproductive biology of herons, egrets, and ibis nesting on Pea Patch Island, Delaware- May through September, 1975. Delmarva Power Light Co. Unpubl. rep. 130 pp.

Life history aspects of herons, egrets, and ibis nesting on Pea Patch Island were studied from May to September 1975 to evaluate man-related factors affecting their nesting success. Avian mortality on utility wires was assessed as was flight behavior of birds approaching existing power lines. Walking surveys under a 500 kV line failed to produce any evidence of wire-induced ardeid casualties. When birds approached power lines, they either elevated or lowered their flight height or ceased wing-flapping and glided through the wires. Under adverse flying conditions (high headwinds, heavy rains, or dense fog), waders either flew close to the water surface, or delayed their departure from the island until flying conditions improved.

826. _____. 1977. A study of the reproductive biology of herons, egrets, and ibis nesting on Pea Patch Island, Delaware; report for the period March through September 1976. Delmarva Power and Light Co. 179 pp.

Aspects of the reproductive biology of herons, egrets, and ibis nesting on Pea Patch Island are presented. The purpose of the study was to evaluate the possible effects of a proposed 500 kV power line crossing the Delaware River approximately one mile north of the heronry. Major flight routes for each species were determined throughout the 1976 nesting period. Walking surveys failed to reveal wire-induced wader mortality under a nearby high-voltage power line.

827. Willard, D. E., J. T. Harris, and M. J. Jaeger. 1977. The impact of a proposed 500 kV transmission route on waterfowl and other birds. Public Util. Comm., Salem, Oreg. 89 pp.

From October 1976 to April 1977, a study was made to determine the potential impact of a proposed power line through areas used by waterfowl, pelicans, cranes, and other birds in the Klamath Basin, Oreg. Data were collected on flight height, weather conditions, and movement patterns as well as mortality along existing lines. During spring 1977, five stretches of line were checked and 23 birds, including 14 American Coots, were recovered. Most of the birds were found under distribution lines. Daily checks were not made and the effect of scavenger removal was not adequately assessed. One transmission line and one distribution line were checked in fall 1976 on 12 dates, and 18 birds were found, 9 at each site. Ten of the casualties were Pintails. Records from the Klamath Basin National Wildlife Refuge during 1962-76 listed 194 dead birds of 8 species, including 47 White Pelicans and 116 Pintails, as having been killed by colliding with overhead wires. In February 1977, the Klamath Wildlife Area reported 32 dead birds in three weeks along a 4-mile stretch of 69 kV lines. In April 1977, 27 dead birds were found along 1 1/4 mile of 69 kV line checked on seven dates. The following conclusions are made: (1) large birds such as pelicans and swan are particularly vulnerable to collisions with overhead wires; (2) low-level movements under conditions of strong wind and poor visibility increase the possibility of strikes occurring, although birds run into wires regularly even in clear, calm, bright weather; (3) the impact on easily found species is usually an overestimate; and (4) scavenging, though it occurs, is probably trivial.

828. Willard, D.E., and B.J. Willard. 1978. The interaction between some human obstacles and birds. Environ. Manage. 2(4):331-341.

The first part of this report is devoted to a review of the bird collision situation with both fatal and nonfatal interactions considered. Next, the authors report on their methods to gather data on the flight patterns of birds, particularly waterfowl, in the vicinity of power lines. Observations at several locations under a variety of conditions are related. Finally, bird-obstacle interactions are discussed under three categories: (1) objects which are used by birds but do not appear to cause increased mortality, such as the use of utility poles as nest or perch sites; (2) objects that cause behavioral changes that are not of themselves harmful, but may become so when combined with other events, such as a power line that causes waterfowl to alter their flight path in the presence of hunters or under poor visibility conditions; and (3) obstacles that are directly lethal or crippling, such as towers and tall chimneys that kill many birds, especially when illuminated.

829. Willet, G. 1945. Does the Russet-backed Thrush have defective eyesight? Condor 47(5):216.

The high number of this species (Swainson's Thrush) ported killed by striking windows prompted this query. (See Ross 1946 and Snyder 1946 for more on the same subject.)

830. Willey, C. H. 1968. The ecology, distribution, and abundance of the Mute Swan (Cygnus olor) in Rhode Island. M.S. Thesis. Univ. of Rhode Island, Kingston. 93 pp.

Flying into objects, especially power lines, is the highest (26.7%) known cause of death among adult swans.

831. Williams, F. 1967. Fall migration: southern Great Plains region. Audubon Field Notes 21(1):51-54.

On 15-16 September 1966, a Dallas Co., Tex. tower killed 200 birds of 27 species.

832. _____. 1973. The fall migration: southern Great Plains region. Am. Birds 27(1):78-82.

On 19-20 October 1972, 65 birds of 17 species died at a Dallas, Tex. TV tower.

833. _____. 1975. The fall migration: southern Great Plains region. Am. Birds 29(1):77-82.

In September 1974, over 110 birds of 23 species were collected beneath towers in the Dallas-Ft. Worth, Tex. area. On 9 October, 177 birds of 28 species were found at a Coweta, Okla. tower (Norman 1975).

834. _____. 1976. The fall migration: southern Great Plains region. Am. Birds 30(1):90-95.

A kill involving over 25 species was reported at a Dallas, Tex. tower in early September 1975.

835. _____. 1977. The autumn migration: southern Great Plains region. Am. Birds 31(2): 194-197, 245.

A migration record from a Wagoner Co., Okla. tower is mentioned.

836. Williams, R. E., and W. B. Jackson. 1974. I. General observations. Bird hazard monitoring contract, Davis-Besse site. Semi-annual rep. June:1-13.

The study of bird mortality due to collisions with various structures at the Port Clinton, Ohio site of Toledo Edison's Davis-Besse power plant was continued in spring 1974. Daily checks, made from 27 April to 1 June, resulted in the recovery of 176 dead birds of 45 species. Most of the casualties were found at the base of the cooling tower (117 carcasses) and around the 300-foot meterological tower (47). During the period 12-18 May, 79% of the total seasonal mortality was recorded. Warblers (69%) accounted for most of the losses with fringillids (8%), vireos (5%), and icterids (3%) killed in lesser numbers. Night observations indicated that mortality occurred more frequently in the early morning hours than before midnight. Mortality by family is given for each of the three previous migration seasons. The locations of the dead birds recovered are indicated on maps of the site.

837. Williams, R. E., W. B. Jackson, and W. A. Peterman. 1975a. Bird hazard monitoring contract, Davis-Besse site. Semi-annual rep. January. 23 pp.

Daily searches made shortly after sunrise from 29 August to 1 November resulted in the recovery of 342 dead birds (47 species), 82% of which were from the cooling tower. Warblers (52%) and kinglets (27%) accounted for most of the losses. The effects of weather on migrant mortality was examined. There was a trend for losses to increase on nights with high potential for migration (northerly wind) and mortality (low ceiling, overcast, precipitation), but the relationship was not clear. However, high mortality was associated with the presence of high pressure systems north or west of Lake Erie. It seems that mortality is more dependent on actual migration volume than on unfavorable weather conditions. Losses to scavengers may have been great, as 76% of the tagged carcasses put out were taken. Daily kill totals are given, and mortality is summarized by family for each of the migration seasons since fall 1972. Maps showing the locations of the casualties at the site are included.

838. _____. 1975b. Bird hazard monitoring contract, Davis-Besse site. Semi-annual rep. June. 14 pp.

From 16 April to 1 June, daily searches were made for dead and injured birds. Only 57 casualties (29 species) were recovered, less than one-third the total for spring 1974 (Williams and Jackson 1974). The cooling tower accounted for 42% of the casualties, with the meteorological tower (30%) and other site structures (28%) accounting for the rest. Warblers (35%), kinglets (16%), and finches (16%) comprised most of the losses. Many of the losses at the meteorological tower were local species associated with open areas, such as around the tower. A newer, free-standing tower had no losses, indicating that guy wires were a factor in the kill at the meteorological tower. The season was generally mild and lacking in inclement weather which kept losses lower than expected. Data support the argument that mortality depends both upon actual migration as well as unfavorable weather conditions. The system of predicting mortality on the basis of synoptic weather patterns seems to be the most appropriate one available. Overall loss of casualties to scavengers was estimated to be 38% based on tagged carcasses placed around the site. Scavengers recorded at the site included raccoons, skunks, muskrats, red and gray foxes, mink, opossums, dogs, snakes, crows, gulls, and Great Horned Owls. Losses during the spring seasons 1973-75 are given by species and family. Maps showing the locations of the losses at the site are included.

839. Wilmore, S. B. 1974. Swans of the world. Taplinger Publ. Co., N.Y. 229 pp.

Mention is made of mortality of Mute, Trumpeter, Whooper and Bewick's Swans through collisions with overhead cables and wires, fences, pylons, television aerials, bridges, buildings, and through electrocution.

840. Wiseman, J. 1975. 1975 TV tower kills. Blue Heron 19(4):5.

Only 175 casualties were recorded during fall 1975 at the CKVR TV tower at Barrie, Ont. This is in contrast to 5000 killed in 1974. Species most commonly killed were the Bay-breasted Warbler, Ovenbird, Red-eyed Vireo, and Chestnut-sided Warbler.

841. Wiseman, J., and J. Hoskin. 1974. Part one: Supplement to O. E. Devitt's "Birds of Simcoe County" - casualties at the CKVR TV tower. Blue Heron 19(1):17-18.

From 1960 to 1973, 4282 birds (75 species) were killed at the CKVR TV tower at Barrie, Ont. Most commonly killed species were the Ovenbird (668), Bay-breasted Warbler (437), Red-eyed Vireo (414), and Chestnut-sided Warbler (313). A composite list of casualties during 1960-73, is given (Devitt 1967).

842. Witzler, S., M. Van Hoose, A. Hyder, S. Heywood, L. George, and J. Clark. 1976. A five week study on window kills during spring migration at Earlham College, Richmond, Ind. Unpubl. rep. 12 pp.

Bird losses were analyzed at windows of buildings on the Earlham College campus in spring 1976. Checks were made at approximately 0700, 1300, and 1900 on 40 days, and 54 birds were collected, mostly of migrating species. Transparency and reflection are important factors in the kill potential at windows. This was a continuation of Bradley's (1975) work.

843. Woodford, J. 1963a. Fall migration: Ontario-western New York region. Audubon Field Notes 17(1):28-31.

Baldwin's 1962 results are mentioned (Baldwin 1963). Over 2000 birds were killed at the Long Point lighthouse in Ontario on 26-27 September 1962, and 744 birds of 45 species died on four nights at a tower in Colden, N.Y.

844. _____. 1963b. Spring migration: Ontario-western New York region. Audubon Field Notes 17(4):399-401.

Two kills were reported from the Long Point, Ont. lighthouse: 237 birds of 24 species on 17-18 May and 65 of 18 species on 19-20 May. Swainson's Thrushes and Veeries were the principal species.

845. _____. 1964. Fall migration: Ontario-western New York region. Audubon Field Notes 18(1):28-30.

Mortality of Dickcissels at the Long Point, Ont. lighthouse is mentioned.

846. Woodford, J., and D. E. Burton. 1961. Fall migration: Ontario-western New York region. Audubon Field Notes 15(1):35-39.

Kills during fall 1960 totalled 936 birds (mostly warblers) of 45 species at the Barrie, Ont. TV tower (Westman 1960), and 532 birds of 45 species at the Long Point, Ont. lighthouse. Overcast skies accompanied both incidents.

847. Woodford, J., and J. Lunn. 1962. Fall migration: Ontario-western New York region. Audubon Field Notes 16(1):25-31.

The results of Baldwin's 1961 survey are discussed (Baldwin 1962). The Barrie, Ont. TV tower accounted for the bulk of the 1115 casualties (57 species) reported.

848. Wray, D. L. 1960. Parasitic Jaeger at Raleigh TV tower. Chat 24(4):97-98.

This unusual species was found dead on 26 August 1960.

849. Wylie, B. 1977. Bird kill at Chestnut Ridge. Redstart 44(2):65.

On 20 October 1975, following a night of fog and rain, 73 birds of 21 species were found dead at the Sand Springs fire tower on Chestnut Ridge, Cooper's Rock State Forest, W.V. The tower is 100 feet tall and sits atop the 2600-foot ridge. It is not lighted and no lights exist anywhere in that part of the forest.

850. Wylie, W. L. 1966. Migration mishap. Redstart 33(4):102-103.

Probably hundreds of birds died on the foggy night of 25 September 1965 at a floodlit compressor station atop a West Virginia mountain. At the site are several buildings and a microwave tower. Most of the casualties ("a truck load") were buried, but 87 dead birds of 26 species were collected.

851. Zani, R. 1967. Recurrence of casualties at Gatlinburg ski resort. Eastern Bird Banding Assoc. News 30(6):243-244.

On 10 October 1967, about 100 birds were killed at a Gatlinburg, Tenn. ski resort, and about 400 were found dead at a condominium near the ski resort on Mt. Harrison. Yellow-billed Cuckoos (80) were the most common among the 22 species identified. Losses have occurred here previously (Savage 1963 and 1965).

852. Ziegler, A. 1952. Three birds dead near an airport ceilometer in Illinois. Migrant 23(4):75.

Only three fall casualties implies either little migration at the time or favorable weather conditions.

853. Zimmerman, D. A. 1975. The changing seasons. Am. Birds 29(1):23-28.

In fall 1974, thousands of birds died at TV towers in nine states and two Canadian provinces, and 150 birds were killed on 18 September at a dark 600-foot smokestack at a New Mexico smelter.

NEWLY ADDED REFERENCES

854. Aldrich, C. 1877. Destruction of birds by telegraph wires. Am. Nat. 11(11):686-687.

In December 1868, near Cambridge, Iowa, many Prairie Chickens were found dead or injured beneath a telegraph line. No exact numbers are given. Because of their rapid flight, slight contact with the wire was enough to maim or kill them. Several similar instances have been reported but insufficient information exists to make even an approximate estimate of the total losses from striking telegraph wires.

855. Alsop, F. J., III, and G. O. Wallace. 1978. Eastern box turtles (Terrapene carolina) feeding on TV tower-killed birds. J. Tenn. Acad. Sci. 53(4):134.

Between 200 and 300 dead and injured birds were collected at the WBIR tower in Knox County, Tenn. on the morning of 8 October 1969 following a night of low visibility and rain. No details of the kill are presented, but the author describes observations of two box turtles feeding on carcasses at the site.

856. Amadon, D. 1966. Confused nocturnal behavior of (? California) gulls. Condor 68(4):397-398.

On the night of 21 April 1964, thousands of gulls were heard calling and milling overhead near Reno, Nevada. The birds were presumably attracted by bright lights of buildings and a highway. There was a wet heavy snowfall during the incident which lasted about 2-1/2 hours.

857. Anderson, H. L. 1977. Barbed wire impales another Great Horned Owl. Raptor Res. 11(3):71-72.

Near Laredo, Texas, on 24 May 1976, an adult owl was impaled by both wings on the top wire of a five-strand barbed wire fence. It was released and flew away.

858. Anderson, W. W. 1975. Pole changes keep eagles flying. Transmission and Distribution 27(11): 28-31.

The efforts of Idaho Power Company to reduce the incidence of eagle electrocution on its power lines are described. Problem sites were identified and modifications to the pole designs were devised to make the sites safe for eagle perching and nesting. (See also Nelson 1975 and Nelson and Nelson 1976.)

859. Andre, J. B. 1979. The Golden-winged Warbler in coastal Carolina: a recent record and comments on the fall migration. Chat 43(3):69.

This species is rare in the Carolinas. One previous specimen was found dead at a Charleston, S.C. tower on 8 October 1954.

860. Anonymous. 1965. Rare Whooping Crane is found dead near Atwood. Goodland (Kansas) Daily News. 5 November: 1.

A Whooping Crane was found dead in a wheat field near Atwood, Kans., on 4 November. The bird apparently struck a nearby power line. An abrasion on one leg was the only visible mark on the bird. A photograph of the crane accompanies the article.

861. _____. 1968. Rare Whooping Crane found near reservoir. Russell Daily News, Russell, Kansas. 16 April:1.

A Whooping Crane was found dead earlier in the week at Lake Wilson, Kansas. The bird had not been shot, and the death may have resulted from a wire collision or some other cause. (Subsequent autopsy by U.S. Fish and Wildlife Service personnel confirmed wire collision as the probable cause of death.)

862. _____. 1976. Power line electrocution - hazards made safer. Conserv. News 41(21):8-10.

Through the combined efforts of the U.S. Fish and Wildlife Service, the Bureau of Land Management, and several utility companies, raptor (mainly Golden Eagle) deaths due to power line electrocutions have declined appreciably in recent years. Pole modifications, wider wire spacing, and improved insulation are primarily responsible for the decrease in mortality from approximately 300 electrocutions in 1970 to 65 in 1975.

863. _____. 1978. Canadians' effort aids wild falcons. Times-Standard, Eureka, Calif. 15 October.

Some of the captive-reared Peregrine Falcons released by the Canadian Wildlife Service have been killed by flying into wires and windows.

864. _____. 1979a. Windows as hazards to birds. Cornell Univ. Lab. Ornithol. Newsl. 91:4.

Birds are probably attracted to windows because of aggression and confusion. During the breeding season, males defending their territories may attack their own images reflected in windows. This probably resulted in very few birds being killed. Most fatal accidents result when a bird flies into a window, perceiving the image reflected or transmitted in the glass to be real habitat or a clear flight path. Such encounters may be prevented by hanging objects that tinkle, glitter, or flutter outside the window; by hanging fine mesh cloth screening in front of the window; or by attaching paper or plastic bird of prey silhouettes to the window. It is also recommended that the potential for bird/window encounters be considered when planning new houses.

865. _____. 1979b. Wire threatens wildlife. S. Dak. Wildl. Parks For. Newsl. 2 Feb. p. 3.

Fences and utility wires cause thousands of wildlife deaths each year. In 1978, over 200 Mallards were killed by striking electric wires at a power station in central South Dakota (Hollevoet 1979, Owens 1979).

866. _____. 1979c. Migrating birds discover a fine friend in Ma Bell. Chicago Tribune, 20 April.

The drapes of two Illinois Bell buildings are closed after each working day during the spring migration to prevent bird strikes at the lighted windows. Each spring, thousands of birds strike tall buildings in Chicago.

867. _____. 1979d. Lights-out policy saves lives of migrating birds, Audubon reports. Ecology USA. 7 May. p. 66.

Excerpts from an article in the New York Times (Webster 1979) are reprinted.

868. Asplundh Environmental Services. 1979. Right-of-way ecological effects bibliography. Electric Power Res. Inst. EPRI EA-1080. 246 pp.

This bibliography contains 824 annotated entries covering the published literature on ecological effects of overhead transmission line rights-of-way through 1977. Entries are arranged under six broad categories: construction and maintenance methods on transmission line rights-of-way, ecological effects of rights-of-way construction and maintenance, literature related to overhead transmission line rights-of-way, environmental assessment methodologies, habitat evaluation techniques, and research procedures. Included are references to avian mortality at overhead wires, television and radio towers, and airport ceilometers. Author, region, and subject indexes are provided.

869. Avery, M. L. (ed.). 1978. Impacts of transmission lines on birds in flight: proceedings of a workshop. U.S. Fish Wildl. Serv. FWS/OBS-78/48. 151 pp. (Supt. Docs. stock no. 024-010-00481-9).

This publication contains several invited papers dealing with the avian mortality due to collisions with electric power transmission lines as well as working group summaries on behavior, habitat, mitigation, management options, and research priorities as they relate to the problem. An extensive bibliography is included.

870. Avery, M. L. 1979. Review of avian mortality due to collisions with manmade structures. Paper presented at Eighth Bird Control Seminar, Bowling Green State Univ., Bowling Green, Ohio, 30 October - 1 November.

Bird mortality due to collisions with radio and TV towers, lighthouses, airport ceilometers, windows, tall stacks and cooling towers, and overhead wires is discussed. Based on long-term studies of towers at Tallahassee, Fla., Nashville, Tenn.; and Buffalo and Elmira, N.Y., a total annual mortality estimate of about 940,000 birds was derived for this mortality source. This estimate is very similar to those obtained by previous investigators (Mayfield 1967, Banks 1979). Some North American lighthouses regularly report casualties, but this is negligible overall. The type of ceilometer presently used at airports causes no mortality to birds. Windows are a major source of avian losses, perhaps totaling 80 million casualties annually (Klem 1979). Tall stacks and cooling towers associated with power plants sometimes cause large kills, but overall are not numerous enough to pose a serious threat to birds. Today there are hundreds of millions of kilometers of power and communication lines, and these may represent the largest source of avian collision mortality. Based on results from Denmark, the Pacific Northwest, and North Dakota, it is suggested that an annual loss rate of one bird per kilometer of wire may be used to characterize mortality at wires in similar situations. Current research into the bird/wire strike problem is summarized. It is concluded that small, steady losses at ubiquitous objects such as windows and overhead wires are of far greater overall magnitude than the episodic losses at tall structures such as TV towers and power plant stacks. The biological significance of collision mortality remains to be determined.

871. Bair, W. C., Disease Biologist, U.S. Fish and Wildlife Service, Pierre, S. Dak. 1978. Letter to Michael Avery, National Power Plant Team, Ann Arbor, Mich. 20 November. 2 pp.

At a wet, marshy area near Broadview, Mont., a large number of waterfowl died due to a botulism outbreak. However, among the carcasses were a number of birds that had apparently died from striking power lines that cross the area. The lines are supported by guyed towers, and it is suspected that many of the collision victims struck the guy wires rather than the power lines. Of 12 live birds that were caught and examined, 4 had struck wires. No estimate of the total mortality is given. A similar dieoff occurred at this area before, and numerous wire-killed birds were noted then also. At another site, a Blue-winged Teal was decapitated when it flew into a utility line that traversed a marsh. The author notes that "it is quite likely, that birds under stress after hitting wires are more susceptible to disease and could be the cause of disease outbreaks in some situations." (Also see Heijnis 1976.)

872. Baird, S. F., T. M. Brewster, and R. Ridgway. 1884. The water birds of North America. Mem. Harvard Mus. Comp. Zool. 13, vol. 2. 552 pp.

Cassin's Auklets were killed on the Farallon Islands in California by flying into camp fires as they returned to their burrows in the early part of the night.

873. Bartolo, B. 1977. Heavy TV tower kill found September 10-12. Audubon Soc. West. Pa. Bull. 42(4):11.

During September 1977 about 315 dead birds were collected at the WFMJ-TV tower in Youngstown, Ohio. The heaviest kill occurred during 10-12 September when 199 casualties were recorded. Bay-breasted and Blackpoll Warblers were the most common casualties, and 16 warbler species were represented in all.

874. Batten, L. A. 1978. The seasonal distribution of recoveries and causes of Blackbird mortality. Bird Study 25(1):23-31.

In Great Britain, traffic appears to be the largest single cause of mortality. Other causes of death include colliding with windows and power and telephone lines.

875. Beecham, J. J., and M. N. Kochert. 1975. Breeding biology of the Golden Eagle in southwestern Idaho. Wilson Bull. 87(4):506-513.

Golden Eagle breeding biology was studied along the Snake River from 1968 to 1971. Of 28 dead eagles examined, 28% died from electrocution (all immatures) and impact injuries accounted for 21%.

876. Beeman, L., and R. K. Schreiber. 1976. A parcial bibliography - environmental concerns in rights-of-way management. Pages 321-335 in R. Tillman, ed. Proceedings of the First National Symposium on Environmental Concerns in Rights-of-Way Management. Mississippi State Univ.

References to bird mortality at overhead wires, TV towers, and other structures are included in this bibliography that is divided into four main sections: general impacts, rights-of-way construction and vegetation management, impacts on wildlife, and biological effects.

877. Belisle, A. A., W. L. Reichel, L. N. Locke, T. G. Lamont, B. M. Mulhern, R. M. Prouty, R. B. DeWolf, and E. Cromartie. 1972. Residues of organochlorine pesticides, polychlorinated biphenyls, and mercury and autopsy data for Bald Eagles, 1969 and 1970. Pestic. Monit. J. 6(3):133-138.

Of 39 Bald Eagles found sick or dead in 13 States during 1969 and 1970, 4 died from impact injuries and 2 were electrocuted. One of the impact casualties was an eagle which had been struck by a private jet; the others apparently struck power lines.

878. Bell, F. 1978. Bird kills at a generating plant in Ontario. Redstart 45(3):102-103.

The history of bird kills at the two tall stacks of Ontario Hydro's Lennox generation station is briefly reviewed (see Broughton 1977). The first stack was completed in fall 1972, and the first kill (1145 birds) occurred on 12 September. Since then, 10,440 losses have been recorded during fall migration and 793 in the spring seasons. Overall, the most frequently killed species has been the Magnolia Warbler. Yellow-rumped Warblers are killed very infrequently relative to their observed abundance in the field. The opposite is true of the Philadelphia Vireo. There is little correlation between the most frequently killed species at the Lennox plant and those netted at the Allegheny Front Migration Observatory in Grant Co., W.V.

879. Bellrose, F. C. 1971. The distribution of nocturnal migrants in the airspace. Auk 88(2): 397-424.

The night of 30 September - 1 October 1965 was overcast, and 10 birds of eight species, mostly warblers, were killed at a Peoria, Ill. TV tower.

880. Bernard, J., W. Cornatzer, Jr., and F. F. Kelley. 1972. Spring report of tower kills for eastern North Dakota. Univ. North Dakota, Grand Forks. Unpubl. rep. 4 pp.

On 15 April searches for dead birds were made at the KTHI and KXJB TV towers near Blanchard, and at the WDAY tower near Amenia, N. Dak. At KTHI, 50 birds (3 species), including 46 Lapland Longspurs, were collected and other casualties were noted in impassable areas near the tower. At KXJB, 118 birds (7 species), including 102 Lapland Longspurs, were found. No casualties were recorded at WDAY. (Avery and Clement 1972 and Baumann 1973 report additional mortality at these sites.)

881. Blake, C. H. 1958. Skull injuries at a TV tower. Chat 22(3):31.

Following the overcast evening of 11 May, 10 freshly killed birds were found at the WUNC-TV tower near Hillsboro, N.C. - 5 Red-eyed Vireos, 2 Blackpoll Warblers, 2 Common Yellowthroats, and 1 Gray-cheeked Thrush. A Black-throated Blue Warbler and a Kentucky Warbler killed previously were also found. Seven birds had various skull injuries indicating that they may have suffered glancing blows. Locations of casualties around the structure suggested that the birds struck the tower, not its guy wires.

882. Bourne, W. R. P. 1979. Birds and gas flares. Mar. Pollut. Bull. 10(5):124-125.

Previously published articles relating to bird deaths due to incineration at gas flares of North Sea oil production platforms are reviewed (Lid 1977, Sage 1979a,b). The impact of this mortality has been greatly exaggerated because most birds arriving at the oil rigs in inclement weather are doomed anyway due to starvation, exhaustion, or predation by raptors. The normal rate of loss appears to be a few hundred birds per platform per year.

883. Braithwaite, L. W. 1975. Waterfowl on a dry continent. Nat. Hist. 84(5):60-69.

At dry, inland areas in Australia, ducks are often killed at night by crashing into corrugated steel roofs which reflect moonlight and are apparently mistaken for ponds.

884. Broughton, D. 1977. The bird kill problem at Ontario Hydro's thermal generating stations; a study of nocturnal migrant mortality due to impingement at lighted stacks. Ontario Hydro CTS-07017-1. 30 pp.

This report summarizes the bird mortality recorded at Ontario Hydro's Lennox and Nanticoke generating stations since 1970 when the first stack was completed at Nanticoke. Losses at Nanticoke totaled 963 and 17,866 for all of the spring and fall seasons, respectively, with Red-eyed Vireos (705), Magnolia Warblers (705), Common Yellowthroats (553), Ovenbirds (405), and American Redstarts (335) being the most frequently represented of the 5088 casualties (72 species) identified. The spring and fall totals at the Lennox plant were 792 and 7862, respectively. Of the 4656 identified losses (69 species), Magnolia Warblers (969) were the most commonly killed, followed by Red-eyed Vireos (616), Ovenbirds (499), Common Yellowthroats (499), and Bay-breasted Warblers (370). Yellow-rumped Warblers, sparrows, and finches have been killed in very small numbers relative to their abundance during migration. About 500 total losses have occurred at three other Ontario Hydro stations since 1971. Kill totals by date are given for each year and there is a total species list, by season, for both the Lennox and Nanticoke plants. In addition, a chronology of the major events at each of the two sites is included. Previous work at the sites is reviewed, and it is revealed that subsequent analyses using corrected data showed there was a significant correlation between the stack lighting methods and bird losses at Nanticoke, contrary to previous conclusions (Johansen 1975). (Additional details on the stack lighting modes and their effects on bird losses are found in Johansen 1975 and Weir 1977b.)

885. Buxton, E. J. M. 1957. Impression left by birds striking glass windows. Br. Birds 50(9):393.

Photographs of imprints left on two glass windows by pigeons that struck them are presented. One collision was fatal.

886. Byrd, V., Hawaiian Islands National Wildlife Refuges, Kilauea, Hawaii. 1978. Letter to Paul Springer, Wildlife Research Field Station, Humboldt State University, Arcata, Calif. 26 October. 2 pp.

An estimated 15-30 electrocuted eagles were recorded at Adak, Alaska each year 1969-1975. Most casualties were sub-adults, and most electrocutions occurred in winter when eagles concentrated near the Navy base at Adak. On Kauai, Hawaii, fledgling Newell's Manx Shearwaters, a threatened species, frequently collide with man-made structures when they are blinded by lights of towns and resorts.

887. Byrd, V., J. Sincock, and T. Telfer. 1978. The status of Newell's Manx Shearwater, a threatened species. Pacific Seabird Group 5th Annual Meeting, Asilomar, Calif. 13-16 December. (Abstract).

On Kauai, Hawaii, shearwaters are susceptible to collisions with manmade objects such as power lines, buildings, and cars after being blinded by bright lights. This problem is increasing annually due to the development of tourism.

888. Carter, J. H., III, and J. F. Parnell. 1978. TV tower kills in eastern North Carolina: 1973 through 1977. Chat 42(4):67-70.

The WECT and WWAY TV towers in southeastern North Carolina were checked irregularly during September and October 1973-1977. No spring checks were made. WWAY was visited only infrequently because past experience had shown that few losses occurred there. Three large kills were recorded at WECT during the study period: 660+ (39 species) on 30 September and 1 October 1973, 3240+ (41 species) on 4 and 5 September 1974, and 306+ (21 species) on 27 and 28 October 1975. Species lists for each kill are provided. Predators and scavengers removed large numbers of the casualties. The total kill for 1973-1977 exceeded 4200 birds (65 species) compared to 3070 casualties (84 species) in 1971-1972 when checks were made more regularly. During 1975-1977, the most commonly killed species were the American Redstart (784), Ovenbird (597), Red-eyed Vireo (552), Common Yellowthroat (463), and Black-and-White Warbler (434). Since 1971, the species most frequently killed have been the Common Yellowthroat (1023), American Redstart (925), Ovenbird (865), Red-eyed Vireo (701), and Black-and-White Warbler (549).

889. Cassel, J. F., D. W. Kiel, J. J. Knodel, and J. M. Wiehe. 1979. Relation of birds to certain power transmission lines in central North Dakota. Zool. Dep., North Dakota State Univ., Fargo. 50 pp.

A study was performed to determine the effects to bird populations of relocating a 230 kV transmission line within 0.4 km of prime wetlands near Underwood, N. Dak. Casualties along 5 km of the old line were recorded during fall 1977 and spring and fall 1978, after which the line was removed. The new line was monitored during spring and fall 1978. Losses totaled 105 birds of 33 species with common upland breeding birds dominating the list. The most frequently recorded species were the Mourning Dove (17), Chestnut-collared Longspur (14), Horned Lark (11), and Savannah Sparrow (8). No major differences in the magnitude or composition of the losses were noted between seasons or between lines. A casualty rate of about one bird per 10 days per mile of line searched was recorded. Tests revealed no bias due to scavenger removal or detectability by the observer. No satisfactory means was found to estimate the varying density of migrants passing by the lines during the seasons, nor to correlate avian activity near the lines with weather or time of day. Seventy percent of the 1883 birds observed passing by the lines flew under them. Complete casualty lists, maps of casualty locations, and results of scavenger removal trials are included.

890. [Cernohous, L. 1978.] Untitled. U.S. Fish and Wildlife Service Area Office, Bismarck, N. Dak. Unpubl. rep. 5 pp.

A postcard form for recording bird mortality at power lines was developed and distributed to various wildlife offices and individuals throughout North Dakota in April 1978, During the 8 months of the survey, 37 cards were returned with data on 66 casualties of 19 species. The most abundant species were American Coots (15), Snow Geese (11), Great Blue Herons (5), and Gadwalls (5). Waterfowl and coots comprised 54 of the birds found. Lines supported by metal towers accounted for 34 of the losses, distribution lines 25, transmission lines on wooden poles 6, and telephone lines 1. Because of many uncontrolled variables, no definitive conclusions can be drawn based on the results of this survey. However, indications are that birds (primarily waterfowl) strike power lines mainly during inclement weather, in the vicinity of wetlands, with about equal frequency on large and small lines.

891. Clancey, P. A. 1964. The migratory status of the Pygmy Kingfisher in South Africa. Ostrich 35(1):60.

During migration, Ispidina picta is frequently killed by flying into white-walled buildings and windshields of parked cars. (See also Harwin 1978 and Irwin 1978.)

892. Clark, A. R. 1978. Erie County television tower casualties: 1978. Prothonotary 44(2):186-189.

On 27 visits between 25 August and 12 November, 359 birds of 51 species were collected at three towers in the Buffalo, N.Y. area. The most frequently killed species were the Blackpoll Warbler (44), Ovenbird (36), Swainson's Thrush (35), and Red-eyed Vireo (25). This season's mortality brings the 12-year total to about 10,400 birds of 100 species. Spring losses in this region are generally uncommon because most migration takes place with southerly winds that are usually accompanied by clear skies. In the past 7 years, there have been 80 spring casualties of 32 species. Also mentioned are three fall casualties at the WUTV tower at Grand Island, N.Y., and 15 from the Elmira, N.Y., tower. A complete list of casualties by date of collection is given.

893. Colson, E. W., and E. H. Yeoman. 1978. Routing transmission lines through water bird habitat in California. Pages 87-90 in M. L. Avery, ed. Impacts of transmission lines on birds in flight. U.S. Fish Wildl. Serv. FWS/OBS-78/48.

The transmission line routing procedures used by Pacific Gas and Electric Company are presented, and three proposed transmission line projects are discussed in light of their potential impact on water bird populations.

894. Connell, C. E., E. P. Odum, and H. Kale. 1960. Fat-free weights of birds. Auk 77(1):1-9.

Tower-killed specimens from Aiken, S.C. and Tallahassee, Fla. were used to examine fat-free weights of various bird species. All of the hundreds of tower-killed birds examined appeared healthy.

895. Cooke, W. W. 1904. Distribution of North American warblers. U.S. Dep. Agric. Biol. Surv. Bull. 18.

In the various species accounts, there are several references to warblers striking lighthouses.

896. Cooley, C. D. 1977. Television tower casualties at Huntsville, fall, 1976. Ala. Birdlife 25(3,4):14-15.

From 30 September through 31 October, daily collections of bird losses were made at the 1000-foot WHNT television tower. During this period, 42 casualties of 18 species were recorded, the majority (27) being warblers. A list of casualties is given.

897. Cornelius, D., Game Biologist, Alaska Department of Fish and Game, Palmer, Alaska. 1975. Duck strike on powerline. Memorandum to Dan Timm, Waterfowl Coordinator, Alaska Department of Fish and Game, Anchorage. 9 July. 1 p.

An injured Lesser Scaup was picked up beneath a power line at Lake Lucille on 3 July. The injured wing was x-rayed and set, and the bird was released.

898. Crawford, J. E., and L. A. Dunkeson. 1973. Powerline standards to reduce raptor losses on the national resource lands. Draft report. U.S. Dep. Int., Bur. Land Manage. 6 pp.

A survey of national resource lands in the western U.S. in 1971 revealed annual electrocution losses of over 200 eagles and other large raptors. This report recommends design changes in several types of electric power distribution poles that will reduce the likelihood of electrocutions. (Miller et al. 1975, Rural Electrification Administration 1979.)

899. Crawford, R. L. 1978. Autumn bird casualties at a northwest Florida TV tower: 1973-1975. Wilson Bull. 90(3):335-345.

The total mortality during the three migration seasons at the WCTV tower was 3864 birds (109 species). Red-eyed Vireos (896), Ovenbirds (219), Common Yellowthroats (159), and Magnolia Warblers (140) were the species most frequently killed. A complete species list for the period is given with sex and age ratios for each species. Differential migration by sex and age class was exhibited by seven species. The sex and age class data from this study were compared with those obtained from the WDBO tower in central Florida (Taylor and Anderson 1973) and indicated that adults and immatures of some species follow different migration routes due to allopatry on their wintering grounds.

900. Dennis, J. V. 1978. A complete guide to bird feeding. Alfred A. Knopf Co., New York, N.Y. 288 pp.

On pages 75-78, the problem of birds hitting windows is discussed. Strikes can be prevented by hanging a screen of nylon netting or gauze, or something that tinkles, glitters, or flutters, outside the window. Silhouettes of birds of prey may also be effective in deterring birds. All species are not equally prone to hit windows. Purple Finches, House Finches, Mourning Doves, chickadees, and juncos are particularly accident-prone.

901. Devlin, J. M. 1954. Effects of weather on nocturnal migration as seen from one observation point at Philadelphia. Wilson Bull. 66(2):93-101.

On the night of 21-22 September 1953, 300 migrants were killed by striking the Empire State Building.

902. Dharmakumarsinhji, R. S. 1960. Marsh Sandpipers (Tringa stagnatalis) colliding against telephone wires. J. Bombay Nat. Hist. Soc. 57(3):666-667.

Near Bhavnagar, India, on 22 December 1958, a large flock of Marsh Sandpipers flew across a road and three of the birds struck roadside telephone wires and were killed. The following morning at the same place a dozen Marsh Sandpipers were found dead, all apparently having struck the telephone wires during feeding flights. In a note following the article the editor states that ducks are frequently killed by colliding with telegraph wires at the Bharatpur Bird Sanctuary.

903. Early, T. J., Aleutian Islands National Wildlife Refuge, Adak, Alaska. 1978a. Electrocution of Bald Eagles - Adak. Memorandum to Paul F. Springer, Wildlife Research Field Station, Humboldt State University, Arcata, Calif. 6 September. 1 p.

It is estimated that 50 Bald Eagles are electrocuted each year near a dump site in Adak, Alaska. The poles on which most electrocutions occur have two sets of cross beams with the main pole extending only about 1 foot above the top cross beam. Eagles contact two or more wires when landing or perching and are electrocuted.

904. _____. 1978b. Letter to Michael Avery, National Power Plant Team, Ann Arbor, Mich. 22 November. 4 pp.

Hopefully, Bald Eagle electrocutions at the U.S. Naval Base, Adak, Alaska will be reduced by placing perches atop about 25 power line poles and by using an alternate garbage dump, away from any power lines, part of the year. Power line voltages on the base are 6.9 and 13.8 kV.

905. Edscorn, J. 1978a. Florida birds. Fla. Nat. 51(4):30-31.

A "great bird kill" at the Vehicle Assembly Building of Cape Kennedy included as many as 60 Connecticut Warblers. The casualties were not collected, however.

906. _____. 1978b. The fall migration: Florida region. Am. Birds 32(2):193-197.

Losses at the WCTV tower in Tallahassee were scanty during the fall 1977 season.

907. _____. 1979. The autumn migration: Florida region. Am. Birds 33(2):169-171.

Several kill records from the WCTV tower in Tallahassee are mentioned, including over 451 birds of 42 species on 9 November 1978.

908. Ellis, D. H., J. G. Goodwin, Jr., and J. R. Hunt. 1978. Wildlife and electric power transmission. Pages 81-104 in J. L. Fletcher and R. G. Busnel, eds. Effects of noise on wildlife. Academic Press, New York.

The problem of bird mortality due to collision and electrocution at power lines is briefly discussed. The Japanese Crane and the Eagle Owl are examples of species that have suffered appreciable losses due to wire strikes. Eagles in the United States and vultures in southern Africa are particularly prone to electrocutions. Utility companies in the U.S. have cooperated to reduce the electrocution hazard by modifying utility pole design and conductor configurations.

909. Evans, R. E. 1976. Bird impaction on cooling towers. Pages 340-344 in Ichthyological Associates, Inc., An ecological study of the Susquehanna River in the vicinity of the Three Mile Island nuclear station. Ithaca, N.Y.

During March-June 1975, the bases of the four natural draft cooling towers at the Three Mile Island plant were checked for dead birds. Only two collision casualties were found during the period. An additional 20 birds were collected at the trash racks of towers 1 and 2. Previous studies revealed 37 preoperational and 29 postoperational casualties at this site. (See Woodward-Envicon, Inc. 1974 and Woodward-Clyde Consultants 1975.)

910. Flegg, J. J. M., and C. J. Cox. 1975. Mortality in the Black-headed Gull. Br. Birds 68(11): 437-449.

During four periods from 1908 to 1972, the percentage of ringed gulls recovered "dead under wires" varied from 2.1 (1908-1924) to 3.9 (1953-1968). Of birds ringed as nestlings in Britain and Ireland during 1967-1974, 5.7% of the juveniles (6 months old and less) and 4.5% of the adults recovered were killed striking wires.

911. Flegg, J. J. M., and R. A. Morgan. 1976. Mortality in British gulls. Ringing Migr. 1(2):65-74.

The recoveries of six species of gull banded as nestlings in Britain and Ireland during 1967-1973 are analyzed. The category "found dead" accounted for about 70% of the total recoveries. Collision with overhead wires was responsible for appreciable losses among all species except the Common Gull which suffered considerable mortality due to collisions with vehicles.

912. French, T. W. 1972. Clapper Rail in downtown Atlanta. Oriole 37(1):5-6.

Georgia's first interior record of this species was collected at Atlanta's Equitable Building on 1 September 1971. The bird was an immature.

913. French, T. W., Indiana State University, Terre Haute, Ind. 1979. Letter to Michael Avery, National Power Plant Team, Ann Arbor, Mich. 4 May. 2 pp.

While collecting dead birds at the Equitable and Trust Company buildings in Atlanta, Ga., the author collected 12 red bats, Lasiurus borealis; 1 Seminole bat, L. seminolus; 1 evening bat, Nycticeius humeralis; and 3 eastern pipistrels, Pipistrellus subflavus. In addition, one hoary bat, Lasiurus cinereus, was found dead in fall 1976 at a TV tower in Farmersburg, Ind.

914. Garzon, J. 1977. Birds of prey in Spain, the present situation. Pages 159-170 in R. D. Chancellor, ed. World Conference on Birds of Prey. International Council for Bird Preservation. Vienna. 1-3 October 1975.

Overhead cables pose a serious threat to various raptor species in Spain. Among the species found dead from electrocution or collision at overhead wires are the Imperial Eagle, Aquila heliaca; the Black Vulture, Aegypius monachus; and the Eagle Owl, Bubo bubo.

915. Gauthreaux, S. A., Jr. 1978a. Migratory behavior and flight patterns. Pages 12-26 in M. L. Avery, ed. Impacts of transmission lines on birds in flight. U.S. Fish Wildl. Serv. FWS/OBS-78/48.

This is a comprehensive review of factors in avian migration that are of potential relevance to the bird-transmission line collision problem.

916. _____. 1978b. The impact of transmission lines on migratory birds: assessment of completed, ongoing, and planned research and an analysis of future research needs. Clemson Univ., Clemson, S.C. Unpubl. rep. Electric Power Res. Inst. 43 pp.

Among the past or ongoing studies critiqued in this report are Anderson 1978, Kiel and Cassel 1978, Lee 1978, Leitner and Grant 1978, Scott et al. 1972, Wiese 1977, and Willard et al. 1977. The objectives, methods, findings, and shortcomings of each study are described. Future research is needed to determine the magnitude of avian wire strikes and the occurrence and significance of alterations in flight behavior in the contexts of the design and height of the transmission line array, the geographical location and habitat, the time of year and day, the weather conditions, and the types of birds involved. Recommendations for obtaining the necessary information are proposed.

917. Gibson, D. D., University of Alaska Museum, Fairbanks. 1978. Letter to Paul Springer, Wildlife Research Field Station, Humboldt State University, Arcata, Calif. 26 October. 2 pp.

The following individual birds have been recorded as collision deaths in Alaska: Arctic Loon (Point Barrow; lengths of steel reinforcing bars protuding from the ground), Golden Plover (Shemya Island; guy wire), Wood Sandpiper (Shemya Island; guy wire), Bullfinch (Anchorage; window), Ancient Murrelet (Buldir Island; building). In addition, Swainson's and Gray-cheeked Thrushes, Dark-eyed Juncos, redpolls, Pine Grosbeaks, Bohemian Waxwings, and Black-capped Chickadees are regularly reported as window kill victims in Fairbanks.

918. Gill, R. 1974. Untitled. Calif. Dep. Fish Game, Sacramento, Calif. Unpubl. rep.

During summer 1974, over 1200 birds, mostly shorebirds, were collected under an electric transmission line in the South San Francisco Bay area. Western Sandpipers (650), Least Sandpipers (239), dowitchers (141), and Dunlins (69) headed the casualty list. Over 1000 carcasses were fluoroscoped and revealed numerous broken wings and no evidence of shot. There are numerous salt evaporating ponds in the area that apparently attract many shorebirds. Photographs of some of the casualties are included.

919. Gillard, R. 1977. Unnecessary electrocution of owls. Blue Jay 35(4):259.

On 28 July 1975, a fully grown young Great Horned Owl was found dead under an electric power pole near Wynyard, Sask. Apparently, it had been electrocuted when the snowshoe hare it was carrying touched the ground wire and created a short circuit. A similar incident occurred at the same pole on 20 August 1972. Of 207 recoveries of banded Great Horned Owls, 13 were electrocuted. The author calls for modifications of the poles to reduce the electrocution hazard. In a note following the article, the editor states that a similar situation exists in Manitoba where raptors, especially Snowy Owls, are frequently electrocuted.

920. Goodpasture, K. A. 1978. Television tower casualties, 1976. Migrant 49(3):53-54.

In Nashville, Tenn., during fall 1976, 406 birds of 43 species were collected at the WSM (292) and WNGE (114) towers. Ovenbirds (63), Tennessee Warblers (61), and Magnolia and Bay-breasted Warblers (55) topped the casualty list. Several examples are given of disparate same-night casualty counts at the two towers which are only 7 miles apart. House cats and foxes frequently remove carcasses. Casualty lists for the two towers are given with dates of collection.

921. Goodwin, C. E. 1978. The fall migration: Ontario region. Am. Birds 32(2):197-200.

Several large kills were reported at lighthouses and tall chimneys during the fall 1977 migration season. At the chimneys of Ontario Hydro's Lennox plant, kills of 908, 259, and 1172 birds were recorded on 23-24 August, 11-12 September and 20-21 September, respectively. A kill of 415 birds was recorded at the Nanticoke plant on 23-24 September. These losses resulted from the stack lights having been mistakenly left on (Weir 1977b). On four consecutive nights, from 17-18 to 21-22 September, kills of 1339, 101, 749, and 3190 were recorded at the lighthouse on Great Duck Island. The Long Point lighthouse reported losses of 440 birds on 17-18 September, 384 on 18-19 September and 530 on 23-24 September. No details concerning these incidents are given.

922. _____. 1979. The autumn migration: Ontario region. Am. Birds 33(2):171-174.

On 12 September 1978, 42 Connecticut Warblers were killed at the Long Point lighthouse.

923. Gosselin, M. 1978. The winter season: Quebec region. Am. Birds 32(3):324-326.

A Lesser Black-backed Gull was found dead beneath a power line at Beauharnois on 3 December 1977.

924. Graber, R. R., and W. W. Cochran. 1960. Evaluation of an aural record of nocturnal migration. Wilson Bull. 72(3):253-272.

This article compares aural recordings of migrating bird with tower kill incidents at the nearby WCIA-TV tower, Champaign Co., Ill. Daily checks of the tower were made during the migration seasons of 1957 and 1958. The only kills exceeding six birds occurred on 21-22 September 1957 and 15-17 September 1958. (See Graber 1968 for details of the mortality incidents.)

925. Guillory, H. D. 1973. Motor vehicles and barbed wire fences as major mortality factors for the Least Bittern in southwestern Louisiana. IBBA News 45(5):176-177.

From 13 May to 14 July 1973, four Least Bitterns were found impaled on barbed wire fences along a highway in the Sabine National Wildlife Refuge, Cameron Parish, La. During the same period, 12 Least Bitterns were killed by motor vehicles on the highway. The refuge manager reports that waterfowl and egrets commonly strike fences and telephone wires on the refuge.

926. Gunn, W. W. H., J. A. Livingston, and F. A. Lewis. [1972.] A preliminary examination of the bird impact problem at the Nanticoke plant, Ontario Hydro electric system. LGL Limited, Toronto, Canada. 32 pp.

This report reviews the avian mortality recorded at the Nanticoke generating station in 1970 and 1971. The primary cause of death was fractured skulls, probably from collisions with the stacks or adjacent buildings. Casualties were recorded in fewer numbers and on fewer nights in spring than fall. During fall migration 3603 birds (57 species) were killed in 1970 and 755 (45 species) in 1971. Warblers and vireos were predominant both seasons, with Magnolia Warblers (419), Red-eyed Vireos (376), Common Yellowthroats (355), and Ovenbirds (255) the most commonly killed species in 1970 and Red-eyed Vireos (126), Golden-crowned Kinglets (105), Magnolia Warblers (66), and American Redstarts (61) heading the kill list in 1971. The bulk of the casualties were birds of the year. Kills were more likely to occur after the passage of a cold front than during other types of weather. Species that appear most liable to collide with the Nanticoke stacks are small birds of the northern forest accustomed to operating effectively in low light intensities. When these nocturnal migrants encounter strong artificial lights, their ability to perceive the horizon is impaired and disorientation results. They may become locked into a brightly lit area within which they fly until they crash into a structure such as a stack or until dawn comes and they can once more establish horizon cues. It is recommended that further studies involving various lighting schemes and observations of nocturnal bird behavior be conducted at the plant. Complete lists of casualties are provided for 1970 and 1971, and the last five pages (Appendix IV) of the report are a photocopy of Bradstreet and Woodford (undated) concerning bird losses at Long Point lighthouse 1960-1969.

927. Hachisuka, M. U. 1926. Birds of the Eiffel Tower. Ibis 2(4):834.

During summer and fall 1925, the Eiffel Tower was lit by powerful multi-colored lights to about 250 meters above the ground. In late September, migrants were killed as they passed by, and were apparently attracted, to the structure at night. No exact count is given.

928. Hanson, P., S. Herman, and H. Putnam. 1972. Ornithology project report: a count of birds killed at tower site. Valley City State Coll., Valley City, N. Dak. Unpubl. rep. 8 pp.

A 300-foot guyed tower near Valley City, N. Dak. was checked for dead birds on 19 occasions between 24 March and 12 May. Ten birds (seven species) were found, including four Clay-colored Sparrows.

929. Harvie-Brown, J. A., J. Cordeaux, R. M. Barrington, A. G. More, and W. E. Clarke. 1886. Report on the migration of birds in the spring and autumn of 1885. British Association for the Advancement of Science. Edinburgh. 173 pp.

Observations of light keepers throughout the British Isles are compiled and include many reports of birds striking the lights.

930. _____. 1887. Report on the migration of birds in the spring and autumn of 1886. British Association for the Advancement of Science. Edinburgh. 174 pp.

Many references to birds killed by striking the lights of the numerous stations through the British Isles are included in the migration reports from the light keepers.

931. _____. 1889. Report on the migration of birds in the spring and autumn of 1887. British Association for the Advancement of Science. Edinburgh. 175 pp.

Included in the various accounts from light keepers throughout the British Isles are numerous references to birds striking the lights. This is the ninth, and final, report of the series.

932. Harwin, R. M. 1978. The lesser window-bashing kingfisher. Honeyguide 93:19-20.

Nearly 60% of the study skins of Ispidina picta in the Rhodesian National Museum were obtained from birds killed by flying into windows or white walls. Two other migrating kingfishers, Halcyon senegalenis and H. leucocephala, also display this tendency.

933. Heijnis, R. 1976. Vogels onderweg. . . .ornithologische mortaliteits en milieu aspekten van bovengrondse hoogspanningstraces. (The effect of high-voltage overhead wires on bird-mortality and environment in the Netherlands.) [in Dutch, English summary]. Ornithological Research Foundation. 159 pp.

In the Netherlands, from 1971 through 1975, bird mortality was monitored along 2850 mi of 150 and 380 kV transmission lines through meadow habitat. Throughout the study, 2968 dead birds of 73 species were recovered. Species most frequently found were Coot, Fulica atra, (522); Mallard (245); pigeons, Columba spp. (222); Black-tailed Godwit, Limosa limosa, (173); Snipe, Gallinago gallinago, (165); Lapwing, Vanellus vanellus, (162); and Herring Gull (103). Because many casualties may go unrecovered, total losses may have numbered about 4000, or 700/km/yr for both the 150 kV and the 380 kV lines. Losses usually occurred during periods of fog or drizzle. Thirty-six percent of the losses were found directly beneath the wires, and 59% were within 60 m of the line. Victims at greater distances were mostly injured birds. Many birds fly away, seemingly unharmed after contacting conductors, but they may die later from injuries. During daytime, 90% of the birds observed crossing the lines flew above, 5% between, and 5% under the wires. Wounded birds were tracked up to 2 km from the power lines. Injuries most often observed were broken wings, damaged foreheads, and hemorrhages. Four kinds of mammals and eight species of birds were observed preying on the casualties. Kestrels, Falco tinnunculus; Marsh Harriers, Circus aeruginosus; and Black Crows, Corvus corone were the most common predators. Several trials showed that 70% of the test carcasses were removed by predators within 24 hours. Removal of dead birds was higher in the vicinity of the lines than nearby, indicating that perhaps overhead wires attract predators and scavengers. Large numbers of dead birds and proper weather conditions might create conditions conducive to disease outbreaks, and wounded birds may spread disease germs. Under normal weather conditions, 85% of the losses occurred at night, late evening, or early morning. Electrocution does not seem to be a problem in the Netherlands. The presence of overhead wires seem to inhibit nesting on the study site resulting in a loss of about 200 pairs of breeding birds. Bird losses due to collisions with overhead wires may total 800,000 to 1,000,000 annually throughout the country. Four measures are suggested for decreasing this mortality. (1) Although very costly, hazardous cables can be buried. (2) Overhead wires should be incorporated as often as possible into other structural projects such as bridges, harbors, and industrial parks. (3) All wires should be at one horizontal level; wires at different heights usually cause more collisions. (4) The lines could be marked to increase their visibility by using reflecting bird of prey silhouettes, yellow halogenous lamps, or rotating reflective discs. Copies of the report can be obtained by writing to the author: René Heijnis, Wilhelminastraat 13, Kood a/d Zaan, Holland. (From English summary.)

934. Herbert, A. D. 1970. Spatial disorientation in birds. Wilson Bull. 82(4):400-419.

The author proposes that bird collisions with lighted, manmade structures occur when the birds become spatially disoriented within a bright light because of the loss of true visual cues to the horizontal. The light source may be either a direct beam, such as an airport ceilometer, or the refracted and reflected light from the aircraft warning lights of tall towers during rainy, misty weather. The author illustrates his theory using the case of 58 Blackburnian Warblers that were killed flying into brightly lit buildings at a Royal Canadian Air Force Base in September 1961 and published accounts by Hochbaum (1955), Howell (1955), Laskey (1956a), Tordoff and Mengel (1956), Stoddard (1962), and Baldwin (1963).

935. Hochbaum, H. A. 1955. Travels and traditions of waterfowl. University of Minnesota Press, Minneapolis.

On pages 166-167, the author discusses weather-related mortality among waterfowl. Ducks are frequently killed by hitting telephone wires, and geese are known to fly into lighthouses and buildings during snowstorms. At Brandon, Manit., in fall 1943, numerous ducks, mostly Lesser Scaup, were killed by striking an airplane hanger door.

936. Hollevoet, R., U.S. Army Corps of Engineers, Pierre, S. Dak. 1979. Waterfowl mortality due to transmission line collision. Memo to files. 8 January. 1 p.

On 22 December 1978, approximately 180 birds were found dead or injured beneath two large transmission lines at the Oahe Dam in South Dakota. The losses occurred in the early morning amidst winds gusting to 45 miles per hour. All of the birds collected were Mallards except for four Canada Geese, one Wood Duck, and one Common Merganser. Possibly another 50-100 birds were overlooked due to tall vegetation.

937. Holyoak, D. 1971. Movements and mortality of Corvidae. Bird Study 18(2):97-106.

Small numbers of British corvids are reported killed by road traffic and by striking overhead wires.

938. Houston, S., Saskatoon, Sask. 1972. Letter to Paul Springer, Assistant Director, Northern Prairie Wildlife Research Center, Jamestown, N. Dak. 10 April. 1 p.

On 20 September 1971, 53 birds (15 species) were killed at the CKCK TV tower in Regina, Sask. Warblers dominated the kill.

939. Humphreys, G. R. 1930. Observations on the migration of birds at Irish light-stations during the year 1928. Irish Nat. J. 3(4):83-89.

Among the migration records listed are casualties at various Irish lighthouses and lightships.

940. Irwin, M. P. S. 1978. The life and death of the Pygmy Kingfisher Ispidina picta in Rhodesia. Honeyguide 93:29-33.

During its nocturnal migration, this species frequently is killed by striking windows and walls in populated areas.

941. James, B. W., and B. A. Haak. 1979. Factors affecting avian flight behavior and collision mortality at transmission lines. Bonneville Power Administration, Portland, Ore. 109 pp.

This was a continuation of work done by Lee (1978b) and Meyer (1978). The present study examined bird flight behavior and collision mortality at one Oregon and four Washington sites between September 1978 and February 1979. The study sites were all in wetland areas and included 230 kV and 500 kV transmission lines of delta, stacked, and horizontal configurations. Overall, 37 dead birds and 70 feather spots were recorded during the study. Green-winged Teal, American Coots, Starlings, Brewer's Blackbirds, Red-winged Blackbirds, and Glaucous-winged Gulls were the most common collision victims. Of the 23 observed collision incidents, 19 involved overhead ground wires. Birds approaching a transmission line at heights above the ground wires usually did not react to the line, whereas most of the birds approaching at below ground wire height did react by changing height or direction. Daytime collision rates were estimated by two means. Estimator no. 1 related the number of dead birds found beneath a section of line to the estimated flight intensity across the line. The dead bird counts were adjusted to account for biases due to unsearchable habitat, predator removal of carcasses, carcasses not detected by the investigator and crippled birds that landed outside the study area. Total daytime collisions at the Lower Crab Creek, Saddle Mountain Lake, and Bybee Lake study areas were estimated to be 454, 108, and 47, respectively, and the daytime collision rates for waterfowl flying at or below ground wire height were 0.57%, 0.51%, and 0.46%. Estimator no. 2, using only the observed daytime collisions for a known number of birds crossing the

line, provided collision rates of 0.21% for Lower Crab Creek and 0.58% for Saddle Mountain Lake. Nighttime collision rates were higher than those in daytime, although the estimated number of nighttime collisions was much lower than the daytime estimates. Inclement weather affected flight intensity and height but no clear relationship between collision mortality and inclement weather was found. No collisions were observed in conjunction with hunting, and hunting opportunities near the power lines were actually reduced because birds usually increased flight altitude as they approached and crossed the lines. Birds flushed near transmission lines probably are more susceptible to collision than those routinely crossing the lines. At one site, observations were made before and after the line was energized and no differences in flight behavior were noted. Vulnerability to collision varied among species and was determined to a great extent by their flight behavior. Dabbling ducks had the highest collision percentages of all birds at each site. Mallards tended to pass over the lines rather than through them, but teal were more likely to try to pass through the lines. Birds passing through the lines had much higher collision rates than those that tried to pass over them. Most collisions involving American Coots probably occurred during night flights. Common Mergansers apparently were vulnerable to collisions because of their tendency to fly at relatively low altitudes. The susceptibility of Starlings and blackbirds to collision may be due to their flocking behavior. Overall, the biological impact of the avian collision mortality recorded was not significant except perhaps for the estimated loss of 21 Common Mergansers from the Saddle Mountain Lake population of about 150. Recommendations for further study include assessing the effectiveness of removing the ground wire to reduce collisions, and using only the number of birds approaching a transmission line near line height (rather than the total number of flights) as a basis for estimating collision rates. Dead bird searches should be conducted daily in conjunction with flight observations, and attention be given to the size of flocks in assessing the true collision potential of a site.

942. Jaroslow, B. N. 1979. A review of factors involved in bird-tower kills, and mitigative procedures. Pages 469-473 in G. A. Swanson, tech. coord. The Mitigation Symposium: a National Workshop on Mitigating Losses of Fish and Wildlife Habitats. U.S. For. Serv. Gen. Tech. Rep. RM-65.

Estimated losses of between 5 million (Banks 1979) and 80 million (Klem 1979) birds annually due to collisions with manmade structures are attributed to three major factors: invisibility, deception, and confusion. An overhead wire or other structure becomes "invisible," and hence hazardous, when a bird's attention is directed elsewhere, such as toward the pursuit of prey. Deception is exemplified by birds that collide with windows because the reflected image is perceived as an actual flight path or habitat. Confusion results in large, dramatic single-night kills at tall, lighted structures when, under overcast conditions, birds are deprived of celestial cues and lose their orientation. Behavioral aspects of the collision problem are discussed in the contexts of various theories of bird navigation on orientation. Mitigative measures proposed include better siting of overhead wires, altering the reflectivity of glass surfaces, eliminating unnecessary structure illumination, and developing an appropriate on-off cycle for warning lights on tall structures.

943. Jenkins, D. 1955. Causes of death in partridges. Bird Study 2:42-43.

From December 1952 to March 1955, 43 adult Perdix perdix killed in Hampshire, England were autopsied. Fourteen birds died by violent means: collision with trains, cars, wires or fences, or hawk predation.

944. Jewell, D. G., and M. M. Jewell. 1978. Migration casualties in downtown Baltimore. Md. Birdlife 34(4):175-177.

For two years, beginning 16 November 1976, 53 dead or injured birds were recorded at the 13-story Maryland State Office Center building in Baltimore. Losses occurred mainly in September and October, but some mortality also took place in the months of April, May, August, and November. The building is not floodlit. Thrushes, warblers, and sparrows dominated the casualties which are listed by date of collection.

945. Jurek, R. M., California Department of Fish and Game, Sacremento. 1976. Letter to G. S. Grant, Department of Biology, University of California, Los Angeles. 7 October. 2 pp.

In California, water birds commonly strike wires or power lines over coastal wetlands and shorelines. The study of Gerstenberg (1972) is mentioned and it is stated that 250 carcasses, including many Least and Western Sandpipers, were found under an 1100-foot segment of power line in south San Francisco Bay. Hundreds more were found washed up on dikes at nearby areas (Gill 1974).

946. Kaiser, G. W. and K. Fry. 1980. Ingestion of lead shot by Dunlin. Murrelet 61(1):37.

During 1977-1979, on the Fraser River delta in southwestern British Columbia, 54 Dunlin were recorded killed by striking electric transmission lines near nests and feeding areas. Five of the birds had ingested lead shot.

947. Kaiser, G. W. and R. McKelvey. 1978. Destruction of birds by man-made objects. Unpublished manuscript. Draft. 7 pp.

Power line collisions involve more species that commonly believed. Overhead wires are the major source of mortality among greater Sandhill Cranes on their California wintering grounds, and in southwestern British Columbia, an estimated 12 Great Blue Herons are killed annually at power lines in agricultural areas around Delta. Trumpeter Swans have also been recovered beneath power lines at Delta and at Port Alberni, Vancouver Island. In the Vancouver area, the most lethal wires are the 5 cm cables leading to the Roberts Bank Superport jetty. Surf Scoters, American Wigeon, Glaucous-winged Gulls, and shorebirds are regularly found dead under those wires. Birds feeding in the tidal zone must cross these wires two or four times a day and become confused as they climb over the cables. Usually it is only the lower tail of the flock that collides, but even at slow speed, the impact is always fatal. Among shorebirds, the kill rate varies with species. Dunlins are killed sporadically and the incidents appear to be weather dependent. However, Western and Least Sandpipers are killed so often that Marsh Hawks, Merlins, and Glaucous-winged Gulls patrol the area regularly for casualties. Driftwood logs pulled up along the beach pose a collision hazard to nocturnal sea birds returning to their nests and to fledgling Cassin's Auklets as they try to fly to the sea. To eliminate the hazard to birds, the Port Alberni power lines were marked with fishing floats bolted to the conductors. Since then, the loss of swans has almost been eliminated. The large cables at the Roberts Bank Superport will be buried which will eliminate that hazard.

948. Kantrud, H. 1972. Untitled. U.S. Fish Wildl. Serv. Jamestown, N. Dak. Handwritten, unpublished report. 1 p.

On 9 September, 17 birds of 8 species were collected during a brief search at the CJAY TV tower near Winnipeg, Manitoba. Blackpoll Warblers (5) and Ovenbirds (4) were the most numerous species.

949. Keymer, I. F. 1958. A survey and review of the causes of mortality in British birds and the significance of wild birds as disseminators of disease. Part I. A survey of the causes of mortality. Vet. Rec. 70(36):713-720.

Post-mortem examinations of 513 birds (74 species) were conducted during 1 March 1954 - 31 October 1957. Violence, including collisions and predation, accounted for 98 deaths, with House Sparrows (30) and pheasants (16) comprising nearly half of this category. The author mentions lighthouses, lightships, and overhead wires as sources of collision mortality, but offers no details.

950. Kibbe, D. P. 1978. The fall migration: Niagara-Champlain region. Am. Birds 32(2):200-203.

Over 3800 birds, including 1227 Bay-breasted Warblers were killed at the Elmira, N.Y. TV tower during 19-24 September 1977. (See Howard 1977.)

951. Kleen, V. M. 1979a. The autumn migration: middlewestern prairie region. Am. Birds 33(2):181-185.

At Olney, Ill., during fall 1978, tower kills were recorded on 22 September (622 birds, 36 species, 80% warblers) and 13 October (54 birds, 19 species).

952. _____. 1979b. Field notes, fall migration. Ill. Audubon Bull. 188:39-52.

The only TV tower kill reports for fall 1978 in Illinois came from Olney where 622 bird (36 species, 80% warblers) were found on 22 September, and 54 birds (19 species) were collected on 13 October.

953. Kothman, G. H., and G. W. Litton. 1975. Utilization of man-made roosts by turkey in west Texas. Pages 159-163 in K. Halls, ed. Proceedings of the 3rd National Wild Turkey Symposium.

The Wild Turkey has extended its range due to the presence of power lines and poles and other man-made structures that are used as roost sites. At one power company substation, several turkeys were electrocuted because of the maze of poles, wires, and transformers.

954. Kroodsma, R. L., Union University, Jackson, Tenn. 1971. Letter to Paul Springer, Assistant Director, Northern Prairie Wildlife Research Center, Jamestown, N. Dak. 20 December. 1 p.

On 20 and 27 September 1966, a total of 22 dead birds (15 species) were found dead at three towers in eastern North Dakota. American Coots (5) and Lincoln's Sparrows (3) were the most numerous species. Most (18) of the casualties were found at one tower [KXJB-TV, near Galesburg]. Owl feathers at one site indicated some scavenging took place. One Snow Goose was found dead [at KXJB] on a later trip in fall 1966. (See Avery and Clement 1972, and Bernard et al. 1972 for later mortality records at these same three towers.)

955. Kroodsma, R. L. 1978. Evaluation of a proposed transmission line's impact on waterfowl and eagles. Pages 69-76 in M. L. Avery, ed. Impacts of transmission lines on birds in flight. U.S. Fish Wildl. Serv. FWS/OBS-78/48.

The considerations involved in selecting among the proposed and alternate routes for a 345 kV transmission line across the upper Mississippi River are discussed.

956. Krueger, D. M. and R. J. Whyte. 1978. Lesser Scaup collides with fence in south Texas. Bull. Tex. Ornithol. Soc. 11(1):19.

A female Lesser Scaup was found impaled on the top strand of a barbed wire fence on 30 November 1977. The fence bisects a manmade pond frequently used by Lesser Scaup and Ring-necked Ducks on a wildlife refuge near Sinton, Texas. Weather on the presumed day of the accident was overcast, rainy, and windy.

957. Laycock, G. 1973. Saving western eagles from traps and zaps; bobcat baits and power poles take heavy toll. Audubon Mag. 73(5):133.

Perhaps 300 eagles are electrocuted each year at utility poles in the western U.S. In Moffat Co. Colorado, 31 dead eagles were found along a stretch of 88 poles; 47 eagles were found beneath 12 miles of power line in Utah; and 6 eagles were killed at an oil field power line in Texas. The problem also exists in the eastern U.S. Relatively simple modifications to utility poles can prevent most electrocutions, and utility companies are cooperating to effect such changes.

958. Ledger, J. A., and H. J. Annegarn. 1979. Electrocution hazards to the Cape Vulture (Gyps coprotheres) in South Africa. Unpublished manuscript. 17 pp.

Previously published data (Markus 1972, Jarvis 1974) and unpublished records were examined to evaluate the vulture electrocution problem in South Africa. The total number of recorded electrocutions from ranching areas in the western transvaal exceeded 300 during the period 1970-1977. Of the 169 vulture electrocutions documented in unpublished electric company reports, 163 (96.6%) occurred on 88 kV lines where the distance between conductors and the support pole is less than the wingspan of the birds. The support towers of higher voltage (132, 275, and 400 kV) lines provide safe perches for vultures and are regularly used in the area surveyed.

959. LeGrand, H. E., Jr. 1979. The autumn migration: southern Atlantic coast region. Am. Birds 33(2):165-168.

A single Philadelphia Vireo was a tower kill victim at Charlotte, N.C. during the fall 1978 migration.

960. Leitner, P., and G. S. Grant. 1978. Observations on waterbird flight patterns at Salton Sea, California, October 1976-February 1977. Saint Mary's College of California, Moraga, Calif. 80 pp.

"This investigation was designed to collect data on the flight patterns of important bird species at Salton Sea and in adjoining parts of the Imperial Valley. Areas of heavily used habitat were identified and bird movements between these areas were quantified as to numbers, direction, and altitude. . . . A prime objective of the study was to evaluate the potential for adverse impacts on wildlife from new transmission lines and to make recommendations for the mitigation of such impacts." Of the species examined, Cattle Egrets and Snow and Canada Geese were deemed susceptible to collisions because of their flight patterns and height. The most effective mitigation is to avoid known avian flight paths when siting power lines. Besides collision mortality, the presence of power lines may alter flight patterns so that waterfowl are inaccessible to hunters. A list of 87 references on bird/power line interactions is included.

961. [Lewis, G.] 1970b. Television tower - chapter two. Topeka Audubon News 24(5).

In addition to the kill at the Topeka TV tower on 22-23 September (in excess of 260 casualties), kills were also reported at the Empire State Building in New York and at the WBAL TV tower in Baltimore, Md. on 27-28 September. The Baltimore incident resulted in over 1800 casualties of 41 species, the most common of which were the Ovenbird (453), Red-eyed Vireo (391), Black-and-white Warbler (148), Common Yellowthroat (115), and Magnolia Warbler (81).

962. Lid, G. 1977. Birds killed in gas flares in the North Sea [in Norwegian, English summary]. Fauna 30:191-194.

Since 1973, there have been several reports of birds being burnt to death by gas flares in North Sea oil fields (Sage 1979a,b). Particularly large kills were recorded on the nights of 24, 25 and 26 October 1976, with probably tens of thousands of casualties occurring on the latter date alone. It was estimated that 80% of the victims were Starlings, especially juveniles, although many Redwings, Turdus iliacus, and wading birds also died. During these three nights, the weather was humid with occasional fog. (From English summary.)

963. Lincoln, F. C. 1931. Some causes of mortality among birds. Auk 48(4):538-546.

A survey of band returns from small passerines was conducted through 1 November 1928. Of the 16,800 returns (from over 300,000 bandings), 2426 were recorded as "found dead." Collisions, mostly involving windows and wires, accounted for 67 of these. Species most frequently recorded were the Purple Finch (19) and American Robin (9).

964. Lincoln, F. C., and S. R. Peterson. 1979. Migration of birds. U.S. Fish Wildl. Serv. Circ. 16 (revised). 119 pp.

Lincoln's (1950) non-technical review of bird migration is updated through the early 1970's in this revised edition. On pages 58 and 59, under "Perils of Migration," there is a short discussion of avian mortality due to collisions with lighthouses, buildings, TV towers, and the Washington Monument.

965. Lohoefener, R., and C. A. Ely. 1978. The nesting birds of LaCreek National Wildlife Refuge. S. Dak. Bird Notes 30(2):24-30.

Ten Burrowing Owls were found dead in 1 month along a road in the refuge; one bird was found entangled on a barbed wire fence.

966. Luman, I. D. 1978. The Klamath Basin case. Pages 91-104 in M. L. Avery, ed. Impacts of transmission lines on birds in flight. U.S. Fish Wildl. Serv. FWS/OBS-78/48.

This is a review of the circumstances surrounding the routing of a proposed 500 kV transmission line in Idaho and Oregon through some areas used heavily by waterfowl. (See also Willard et al. 1977.)

967. Macdonald, D. 1978. Blackcaps killed by striking window panes. Br. Birds 71(3):132-133.

Five Blackcaps, Sylvia atricapilla, were killed by striking window panes in England during October-November 1976. The clear reflection of trees in the glass is believed to have caused the collisions.

968. Mailliard, J. 1898. Notes on the nesting of the Fork-tailed Petrel (Oceanodrama furcata). Auk 15(3):230-233.

It was impossible to keep a fire lit at night on an island in Sitka Bay, Alaska because of the many Fork-tailed and Leach's Petrels that flew into it.

969. McDonald, J. N. 1979. Waterfowl collisions with utility wires: two observations on the southern plains. Tex. J. Sci. 31(4):369-370.

On 14 May 1976, near Dumas, Texas, a flock of about 15 Northern Shovelers was startled from a slough beside a highway. As the flock passed over and under the utility lines paralleling the road, one female struck a wire and was killed. Later in the day, near Folsom, N. Mex., a pair of Bufflehead was startled from a stock pond. The male struck a utility wire and was knocked unconscious, but the bird recovered and appeared unharmed. These observations both involved migrant birds, presumably unfamiliar with their surroundings, that were startled into flight. They indicate that daytime collisions may be more common than previously thought. In the southern Great Plains, collision frequency probably exhibits a bimodal pattern corresponding to spring and fall migration. The Bufflehead incident indicates that collision frequencies based on dead and injured birds found beneath wires may be underestimates of the actual situations.

970. McGlauchlin, D. C. 1977. Description and chronology of events on Snake Creek embankment. U.S. Fish Wildl. Serv., Audubon Wildlife Refuge, Coleharbor, N. Dak. Unpubl. rep. 9 pp.

From 1972 through 1976, 369 dead birds (37 species) were collected beneath power lines along a 12,800-foot embankment that separates Lake Audubon and the Snake Creek arm of Garrison Reservoir near Coleharbor, N. Dak. Collections were made irregularly during spring (1973, 1974, 1975) and fall (1972, 1974, 1975, 1976) migration periods. Losses consisted almost exclusively of water birds, primarily American Coots (202), grebes (58), ducks (40), and Double-crested Cormorants (21). Some of the casualties may have been killed by cars. It is suggested that more than half of the birds killed by the overhead wires fall into adjacent water and are not recorded. (See McKenna and Allard 1976 for additional information on losses at this site.) The author also lists eight birds, including one Golden and two Bald Eagles, found dead or injured beneath other power lines in the area.

971. Mead, C. J. 1979. Mortality and causes of death in British Sand Martins. Bird Study 26(2): 107-112.

A total of 747 British-banded Sand Martins (Bank Swallows) was examined for cause of death. Road traffic accounted for 142 deaths, 24 struck overhead wires, 4 hit windows, and 2 birds struck fences. Young birds are more likely to be killed by traffic and by striking wires than are older birds.

972. Mead, C. J., P. M. North, and B. R. Watmough. 1979. The mortality of British Grey Herons. Bird Study 26(1):13-22.

The recovery circumstances of 1210 British-banded and 294 foreign-banded Grey Herons, Ardea cinerea, found in Britain and Ireland were examined. Overhead wires accounted for 103 deaths and barbed wire fences were responsible for 8. Shooting was the single greatest specified cause of death (213). Wire victims have increased steadily since 1909 as more power and communication lines have been built. There was no difference between first-year and older British-banded birds in incidence of wire strike mortality.

973. Mehlum, F. 1977. Birds killed at the lighthouse Faerder fyr, Outer Oslofjord, and some possible explanations of bird kills by illuminating constructions (in Norwegian, English summary). Fauna 30:191-194.

During October 1976, 396 birds of 14 species were collected at the Faerder fyr lighthouse in Outer Oslofjord. The Redwing, Turdus iliacus, (246); Song Thrush, T. philomelos, (56); and Goldcrest, Regulus regulus, (61) were the most common casualties. Mass kills were recorded on nights characterized by low pressure, high humidity, overcast, bad visibility, and mist or rain. Various explanations of this phenomenon are reviewed. (From English summary.)

974. Merrie, T. D. H. 1979. Birds and North Sea oil production platforms. Scott. Birds 10(7): 271-275.

This is a brief report of a bird observation scheme established on an offshore oil platform in 1977. During misty weather in autumn, birds are often attracted to the bright lights of the platform. Mortality through burning at the gas flare of the platform occurs, but it is minor compared to other causes, such as exhaustion. During the worst night in fall 1978, approximately eight birds per hour fell from the region of the flare. Such occurrences are very isolated. (See also Sage 1979a,b.)

975. Meyer, J. R. 1978. Effects of transmission lines on bird flight behavior and collision mortality. Bonneville Power Administration, Portland, Ore. 200 pp.

This study, an extension of the work done by Lee (1978b), is one of the most thorough to date on the subject. The author examined bird flight behavior and collisions at seven sites in Oregon and Washington during 22 October 1977 to 31 January 1978 and 19 February to 15 May 1978. The sites selected were all wetland areas in order to represent "worst-case" situations. The transmission lines examined ranged from wood pole 115 kV lines to 500 kV steel tower lines. Observations of birds in the vicinity of the lines were made during daytime, and at night using a night viewing device. Along the 5.9 km of transmission lines examined, 31 dead birds of 12 species were collected, including 11 ducks (8 Green-winged Teal), 5 shorebirds, and 5 Starlings. The majority of the collisions involved ground wires suspended above the conductors. The most commonly observed flight reaction to the transmission lines was a change in height, with most birds flying above the lines. The percentage of observed flights across the lines that resulted in collisions was 0.03 to 0.07 for ducks, 0.04 for Red-winged Black-birds, 0.003 to 0.06 for gulls, and 0.67 for shorebirds. The estimates of collision frequency based on the number of dead birds found were biased by at least three factors: failure of the investigator to locate all carcasses, predator/scavenger removals, and crippling. Methods were employed to estimate the effects of these biases and appropriate correction factors were derived. Bird mortality due to collisions with the transmission lines studied was apparently not biologically significant, but the presence of the lines did appear to interfere with waterfowl hunting.

976. Michener, H. 1928. Where engineer and ornithologist meet: Transmission line troubles caused by birds. Condor 30(3):169-175.

The electrocution of birds at power lines has long been recognized as a source of avian mortality and a cause of power outages. However, on Southern California Edison's power lines, frequent outages are also the result of bird excrement causing flashovers between utility pole insulators. Efforts to eliminate this problem by installing guard pans above the insulators are described.

977. Miller, W. A. 1978. Transmission line engineering and its relationship to migratory birds, Pages 77-86 in M. L. Avery, ed. Impacts of transmission lines on birds in flight. U.S. Fish Wildl. Serv. FWS/OBS-78/48.

Various constraints associated with the design of transmission lines are discussed, and an example of transmission line location is presented illustrating the resolution of some siting conflicts.

978. Mollhoff, W. 1979. Tower kills. Nebr. Bird Rev. 47(3):58.

At the KCNA-TV tower near Albion, Nebr., 80 birds (24 species) were reported killed in 1978. The largest kill was 36 birds on 20 September. Snow Buntings were killed in February and March. A species list is given, but no totals accompany the list.

979. Morgan, R., and D. Glue. 1977. Breeding, mortality and movements of Kingfishers. Bird Study 24(1):15-24.

In Britain, of 151 recoveries of banded Kingfishers, Alcedo atthis, 15% were found dead on roads, 8% died hitting windows, and 3% struck overhead wires.

980. Mulhern, B. M., W. L. Reichel, L. N. Locke, T. G. Lamont, A. Belisle, E. Cromartie, G. E. Bagley, and R. M. Prouty. 1970. Organochlorine residues and autopsy data from Bald Eagles, 1966-68. Pestic. Monit. J. 4(3):141-144.

Sixty-nine Bald Eagles found dead or dying in 25 states during 1966-68 were examined for cause of death. Impact injuries, frequently resulting from collisions with power lines, accounted for 10 deaths, and two were electrocuted at a power line in Alaska.

981. Murarka, I. P., J. G. Ferrante, E. W. Daniels, and E. D. Pentecost. 1976. An evaluation of environmental data relating to selected nuclear power plant sites - Prairie Island nuclear generating plant site. Div. Environ. Impact Stud., Argonne Natl. Lab., Argonne, Ill. ANL/EIS-6.

Bird losses due to collisions with the 345 kV power line at the Prairie Island plant numbered 40 (22 species), 35 (20 species), and 21 (12 species) on 21 April, 23 May, and 13 September 1974, respectively. (See Goddard and Richardson 1974 for a more complete report.)

982. Murphy, R. C., and L. S. Mowbray. 1951. New light on the Cahow, Pterodroma cahow. Auk 68(3): 266-280.

A fledgling female Cahow struck the St. David's Light near Cooper's Island, Bermuda on 6 June 1935. (See Beebe 1936.)

983. Murray, B. G., and J. R. Jehl, Jr. 1964. Weights of autumn migrants from coastal New Jersey. Bird-Banding 35(4):253-263.

Weights of migrants mistnetted along the New Jersey coast were compared with weights of birds killed during migration at Kansas (Tordoff and Mengel 1956), Illinois (Graber and Graber 1962), Georgia (Johnston and Haines 1957), and Florida (Connell et al. 1960). Weights of the New Jersey birds were lowest, indicating a long overwater flight just prior to capture.

984. Newcomb, W. C., U.S. Game Management Agent, Des Moines, Iowa. 1970. TV tower-Iowa. Memorandum to Harvey K. Nelson, Director, Northern Prairie Wildlife Research Center, Jamestown, N. Dak. 30 October. 1 p.

There have been "a lot of birds killed" at the Des Moines airport ceilometer in past years. No details are given.

985. Odum, E. P., C. E. Connell, and H. L. Stoddard. 1961. Flight energy and estimated flight ranges of some migratory birds. Auk 78(4):515-527.

Measured lipid levels and estimated flight ranges are presented for samples of migrants killed at the WCTV tower near Tallahassee, Fla.

986. Owens, D. F., Area Engineer, U.S. Army Corps of Engineers, Pierre, S. Dak. 1979. Letter to Michael Avery, National Power Plant Team, Ann Arbor, Mich. 24 January. 3 pp.

Details of the bird losses at the Oahe Dam (Hollevoet 1979) are given. The incident occurred before 0600 h on 22 December 1978 as part of the wintering flock of 20,000 Mallards was returning from feeding areas northwest of the dam. Northwesterly winds gusted up to 45 miles per hour and the sky was cloudy most of the night. The transmission lines involved were one 115 kV line on wooden H frame poles and one 230 kV line on steel towers. Similar collision incidents at this site have occurred in the past. Birds ordinarily fly through the area without much problem, but high winds cause extreme difficulty in passing over the dam.

987. Peakall, D. B. 1956. Migration at the Smith's Knoll light-vessel, autumn 1953. Br. Birds 49:373-388.

Bird migration as observed from mid-September to mid-November 1953 aboard a light-vessel 90 miles from the coast of Holland is reported. Several casualties from collisions with the light are among the observations listed.

988. Peterson, E. J., Acting Area Manager, U.S. Fish and Wildlife Service, Pierre, S. Dak. 1978. Weekly staff notes. Memorandum to all project leaders and special agents. 2 October. 2 pp.

Among thousands of ducks killed in a botulism dieoff near Broadview, Mont., were a considerable number that appeared injured or killed by wire strikes. The dieoff area has a large high voltage line running through it with guyed support towers. Of 12 live birds caught, 4 had injuries indicating collisions with wires. (See Bair 1978.)

989. Phelps, W. H. 1961. Night migration at 4,200 meters in Venezuela. Auk 78(1):93-94.

On 31 October 1959, at a cable railway station, two Yellow-billed Cuckoos and one Connecticut Warbler were found dead under the railway cables and supporting lower. The birds may have been attracted to the light of the station.

990. Pomeroy, D. E. 1978. The biology of Marabou Storks in Uganda; II. Breeding biology and general review. Ardea 66(1-2):1-23.

In Uganda, Marabou Storks sometimes are electrocuted by flying into overhead power lines.

991. Prawdzik, T., District 8 Wildlife Biologist. 1976. Waterfowl mortality, mouth of Saginaw River. Memorandum to Edward Mikula, Supervisor, Wetland Wildlife Section, Wildlife Division, Michigan Department of Natural Resources. 1 p.

Warm water discharges from power generating units keep part of Saginaw Bay ice-free throughout the year, thus attracting many mergansers and ducks. An estimated 60-65 mergansers were seen dead beneath the network of about 20 power lines that cross above the discharge area. To prevent such losses, it is recommended that discharge water temperatures be lowered to permit open water to freeze or that the power lines be located so as not to cross open water.

992. Purrington, R. D. 1972. The fall migration: central southern region. Am. Birds 26(1):73-77.

Late fall 1971 migration records from the WSM-TV tower in Nashville, Tenn. included one Red-eyed Vireo and three Ovenbirds.

993. _____. 1976. The fall migration: central southern region. Am. Birds 30(1):82-87.

A Blackpoll Warbler killed on 26 October 1975 at a Nashville, Tenn. TV tower was the latest record ever for the species from that locality.

994. _____. 1979. The autumn migration: central southern region. Am. Birds 33(2):185-188.

Losses at the KATV tower in Jefferson Co., Ark. on 21-22 September 1978 included 22 Red-eyed Vireos and 1 Black-throated Blue Warbler.

995. Quigley, E. 1977. Utility line siting and wetlands preservation. Ph.D. thesis. Univ. of Wisconsin, Madison. 231 pp.

In the literature review, the author discusses a few studies of bird losses at utility lines. One of the conclusions reached is that " . . . utility lines can have significant impacts on wetland hydrology and waterfowl."

996. Reidinger, R. F., Jr., and D. G. Crabtree. 1974. Organochlorine residues in Golden Eagles, United States - March 1964-July 1971. Pestic. Monit. J. 8(1):37-43.

The cause of death was determined for 63 of the 169 eagles examined. Impact or electrocution from power lines was implicated in 15 deaths; 18 died from shooting and 5 from collisions with vehicles.

997. Rigby, R. W., Refuge Manager, Bosque del Apache National Wildlife Refuge, Socorro, N. Mex. 1978. Letter to Michael Avery, National Power Plant Team, Ann Arbor, Mich. 19 October. 1 p.

At the Bosque del Apache National Wildlife Refuge, orange aircraft warning markers were placed on power lines (7.2/12.5 kV) traversing the refuge to reduce the incidence of collisions by Sandhill Cranes and, possibly, Whooping Cranes. Prior to the use of markers, two to seven Sandhill Cranes were killed each year from collisions with power lines. No deaths were recorded for 3 years straight after markers were installed. Finally the line was buried.

998. Robertson, J. McB. 1930. Roads and birds. Condor 32(3):142-146.

Between 1 November 1927 and 31 October 1928, a 30.3-mile stretch of road in southern California was traveled 287 times and dead animals were noted along the way. Among the 136 dead birds found were 28 English Sparrows, 16 American Coots, and 15 Western Meadowlarks. There was no way to differentiate between birds killed by traffic and those that struck overhead wires alongside the road.

999. Robinson, A., and S. Wilton. 1973. Owl imprints on window panes. Bird Study 20(2):143.

In Britain, Barn Owls struck windows at two locations and left detailed waxy impressions strong enough to photograph. Neither owl was killed.

1000. Rogers, T. H. 1979. The autumn migration: northern Rocky Mountain-intermountain region. Am. Birds 33(2):196-199.

A Peregrine Falcon hit a window in Montana on 1 October 1978.

1001. Rural Electrification Administration. 1979. Powerline contacts by eagles and other large birds. REA Bull. 61-10 (revised). 7 pp.

This replaces bulletin 61-10 that was issued in March 1972. As in the original, this revision presents methods by which electric power distribution poles can be modified to reduce the danger of electrocution to eagles and other large birds. Among the changes incorporated since 1972 are revised interphase clearances.

1002. Ruttledge, R. F. 1950. Report on observations of birds at Irish light-stations, 1949. Irish Nat. J. 10(2):51-55.

Discussions of the migration records of several species include references to mortality due to striking the lanterns of various Irish light-stations.

1003. _____. 1953. Report on observations of birds at Irish light-stations, 1952. Irish Nat. J. 11(4):99-101.

Casualties at various light-stations are among the migration records discussed. Particularly large kills were recorded at Tuskar where on the night of 8 November, an estimated 5000-6000 birds died. Redwings, Turdus iliacus, dominated the losses. On 14 November, 1200 casualties were collected at Tuskar, with Redwings again the most numerous species.

1004. _____. 1954. Report on observations of birds in Irish light-stations, 1953. Irish Nat. J. 11(7):199-200.

Except for the period 6-9 May, losses at Irish light-stations were rather low. Casualties at the lights are included in several species accounts.

1005. Sage, B. 1979a. Flare up over North Sea birds. New Sci. 81:464-466.

In recent years, there have been numerous instances of mass mortality among nocturnal migrants at gas flares of oil rigs in the North Sea. Incidents generally occur on nights with mist or light fog when birds congregate around the flares and are eventually burned to death. With the exception of one accident which killed several hundred storm-petrels, night migrating land birds, especially Starlings and Redwings, are most frequently involved. The author sees no threat to the survival of the species incinerated by gas flares, but he does decry the uncooperative attitude demonstrated by the oil companies in investigating this phenomenon. (See also Lid 1977.)

1006. _____. 1979b. Bird flare. Birds 7(5):24-25.

Since 1973, a large but unknown number of birds have been killed at gas flares on explorations rigs and production platforms in the North Sea. The incidents have primarily involved night-migrating passerines except for an October 1973 accident that killed several hundred storm-petrels. Several reported incidents are related, and the author calls for more reporting of the mortality by the oil companies.

1007. Sarvis, J., Refuge Manager, U.S. Fish and Wildlife Service, Izembek National Wildlife Refuge, Cold Bay, Alaska. 1978. Letter to Paul Springer, Wildlife Research Field Station, Humboldt State University, Arcata, Calif. 11 August. 2 pp.

A male Steller's Eider found crippled in Cold Bay, Alaska on 5 April 1975 had wounds indicating it had struck an overhead wire. On 26 October 1976, about 150 Brant were killed flying into rigging and masts of boats and the cannery building at King Cove. The birds were flying in snow squalls and heavy wind, and may have been blinded by lights on the boats and cannery. (See also Jones 1976.)

1008. Sayre, R. (ed.). 1971. Omega tower is proving a deathtrap for birds. Audubon Mag. 73(6):110.

An initial death toll of 559 songbirds was reported for the fall migration from this 1250-foot U.S. Navy navigation tower at LaMoure, N. Dak. (See also Anonymous 1972.)

1009. Schlecht, P., L. Hanson, and M. Watterson. 1972. Ornithology project. State Highway Department tower, Peak interchange. Valley City State Coll., Valley City, N. Dak. Unpubl. rep. 6 pp.

A 300-foot guyed tower near Valley City, N. Dak. was checked for dead birds on 13 occasions from 16 April to 16 May. Two dead House Sparrows and one Dark-eyed Junco were collected, and piles of unidentified feathers indicated that additional losses may have occurred.

1010. Scott, L., Indian Head, Sask. 1972. Letter to Paul F. Springer, Northern Prairie Wildlife Research Center, Jamestown, N. Dak. 24 April. 1 p.

In 1970, at the 680-foot CKCK TV tower in Regina, Sask., kills were recorded on the nights of 7-8 September (8 birds) and 8-9 September (56 birds).

1011. Scott, T. G., and T. S. Baskett. 1941. Some effects of the 1940 Armistice Day storm on Iowa's wildlife. Iowa Bird Life 11(1):22-29.

A severe blizzard caused considerable destruction to livestock, fruit trees, and wildlife throughout the north-central states on 11 November 1940. Portions of Iowa reported 50-90% mortality among the Ring-necked Pheasant populations due to the storm. One cock pheasant was found frozen to a fence which it had apparently struck in flight during the storm.

1012. Scott, W. E. 1950. Report on the convention at Two Rivers. Passenger Pigeon 12(2):69-72.

On 7 May, along 5 miles of road from Manitowac to Two Rivers, Wisc., 85 birds (33 species) were found dead or injured under wires. An additional 10 birds found by other persons raised the total losses to 95 of 39 species.

1013. Small, A. 1957. Fall migration: southern Pacific coast region. Audubon Field Notes 11(1): 58-63.

At Lake Murray, Calif., on 24 November 1956, one Whistling Swan was killed by striking an overhead wire.

1014. Smith, R. B., Area Biologist, Alaska Department of Fish and Game, Game Division, Kodiak. 1974. Waterfowl accident. Womens Bay. Memorandum to Dan Timm, Waterfowl Biologist, Alaska Department of Fish and Game, Game Division, Anchorage. 7 May. 1 p.

On 5 May 1974, about 27 King Eiders were killed in two separate instances at a 3-wire telephone line near Womens Bay, Alaska. Weather conditions were rainy with intermittent fog. Some of the carcasses examined had no visible injuries, but others had broken wings, necks, and legs, and bloody nostrils.

1015. Sprunt, A. IV, W. B. Robertson, Jr., S. Postupalsky, R. J. Hensel, C. E. Knoder, and F. J. Ligas. 1973. Comparative productivity of six Bald Eagle populations. N. Am. Wildl. Nat. Resourc. Conf. 38:96-106.

In the discussion following the paper, Eric C. Bolen states that at least 20-30 Bald Eagles die each winter in Texas due to power line electrocutions.

1016. Steenhof, K. 1978. Management of wintering Bald Eagles. U.S. Fish Wildl. Serv. FWS/OBS-78/79. 59 pp.

A review of the literature showed that eagle mortality at power lines occurs primarily during winter when eagles concentrate near human developments. Most electrocution victims are Golden Eagles but Bald Eagles are also susceptible. In the West, accidents are most likely to occur at wooden pole distribution lines located in flat, broad valleys where natural perches are limited. To reduce the hazard of electrocution, it is recommended that land managers do not allow the construction of power lines within 1.5 km of eagle roosts, discourage construction in Bald Eagle wintering areas, follow the guidelines presented by Miller et al. 1975, and document all reported cases of eagle mortality at power lines.

1017. Sterling, E. 1890. Killed in migration. Forest and Stream. 5 June 1890.

In Cleveland, on the nights of 23-24 May, 100 migrant birds were found dead beneath telegraph wires on well-lighted streets. Apparently, inclement weather forced the birds to fly at low altitudes.

1018. Sutton, G. M. 1927. Mortality among Screech Owls of Pennsylvania. Auk 44:563-564.

Since 17 November 1924, 113 dead Screech Owls have been reported in Pennsylvania. Two were killed by striking windows; 82 others apparently were killed by cars.

1019. Switzer, F. 1977. Saskatchewan Power's experience. Blue Jay 35(4):259-260.

Recorded electrocutions of birds on Saskatchewan Power Corporation's power lines average approximately 100 raptors and 100 crows and magpies each year. The frequency of mortality incidents varies with location. Design changes to reduce the hazard to birds are being considered.

1020. Taylor, S. E., and J. M. Ruckel. 1979. Fall mortality at Blackwater Falls State Park. Redstart 46(3):110, 113.

During the night of 7 October 1978, 198 birds (172 Swainson's Thrushes) were killed at the lodge parking lot of the state park near Davis, W.V. The birds may have been attracted to the area by four large lights that keep the parking lot illuminated from dusk to dawn. Freezing rain and sleet fell during the night.

1021. Temme, M., W. B. Jackson, and W. A. Peterman. 1979. Davis-Besse bird hazard monitoring contract, January 1979. Annu. rep. Bowling Green State Univ., Bowling Green, Ohio. 20 pp.

Losses at Toledo Edison's Davis-Besse nuclear power plant were monitored for the seventh fall and sixth spring migration season. Daily surveys were made during 30 April-28 May and 24 September-15 October 1978 with supplementary searches made prior to and following the periods of daily collections. Spring losses totaled 78 birds (30 species) while fall losses totaled 71 (22 species). Warblers comprised 69% and 61% of the spring and fall losses, respectively. The Common Yellowthroat (13), Red-eyed Vireo (10), and Black-and-white Warbler (9) led the spring casualty list, whereas Bay-breasted Warblers (10), Ruby-crowned Kinglets (6), and Common Yellowthroats (6) topped the fall list. All but 14 of the casualties (8 spring, 6 fall) were collected at the power plant's cooling tower; the others were found at various site structures. Necropsies of carcasses showed the most frequent injuries were to the head and bill. Highest mortalities were associated with weather that favored migration, verifying previous findings that mortality is most likely to occur when migration is most expected. However, losses can and do occur under any synoptic weather condition. A complete species list of 1978 casualties is given, and total losses are summarized by family and season for the entire study period, 1972-1978.

1022. Thietje, W. C., Museum of Natural History, University of Iowa. 1970. Letter to Wes Newcome, Federal Building, Des Moines, Iowa. 16 October. 1 p.

A total of 58 birds (16 species) was collected at a TV tower near West Branch, Iowa during fall 1970. Nashville (14) and Yellow-rumped (8) Warblers and Ruby-crowned (9) and Golden-crowned (7) Kinglets were the species most frequently killed.

1023. Thill, J. F. 1978a. The month. Prothonotary 44(5):77-79.

Near Buffalo, N.Y., on the evening of 8 April, a female Ruffed Grouse struck a window and was killed.

1024. _____. 1978b. The month. Prothonotary 44(10):161-162.

Migrant mortality at TV towers in the Buffalo, N.Y. area was light in September because overcast, rainy weather occurred mostly during daylight hours with skies clearing by dusk. The largest kill was on 22 September when 168 birds (35 species) were recorded. The 100th species of this study, which was started in 1966, was recorded on 12 September. (See Clark 1978.)

1025. Trapp, J. L., U.S. Fish and Wildlife Service, Anchorage, Alaska. 1978. Letter to Paul F. Springer, Wildlife Research Field Station, Humboldt State University, Arcata, Calif. 16 November. 1 p.

An estimated 15-25 Bald Eagles were electrocuted each year 1971-1976 at the Adak, Alaska Navy base. Most losses occurred during winter when eagles concentrated near open garbage dumps. At Kodiak, 17 eagle losses were reported from 1970 through 1976. Only two of these died from electrocution; shooting and disease accounted for four deaths each. (See Early 1978a,b.)

1026. Trauger, D. L., Acting Director, Northern Prairie Wildlife Research Center, Jamestown, N. Dak. 1976. Avian mortality from collisions with overhead wires in North Dakota. Memorandum to Regional Director, Region 3, U.S. Fish and Wildlife Service, Twin Cities, Minn. 25 June. 1 p.

Six White Pelicans, one Pintail, and one Ring-billed Gull were found dead near Windsor, N. Dak. from striking a power line. Three or four injured ducks and a crippled pelican were also noted during the week preceding 25 June.

1027. U.S. Fish and Wildlife Service. 1974. Raptor electrocution. Memorandum from the Director to Regional Directors, Regions 1, 2, 3, 4, 5, 6, and Alaska Area Director. 4 pp.

This memo includes a list, by species and Fish and Wildlife Service regions, of the raptor electrocution losses recorded during 1973. Of the 129 birds found nationwide, 115 were Golden Eagles and 6 were Bald Eagles. The western half of the U.S. accounted for 114 of the casualties.

1028. _____. [1980.] Compilation of bird strikes on powerlines (1978-1979). U.S. Fish and Wildlife Service Area Office, Bismarck, N. Dak. Unpubl. rep. 3 pp.

Reports of 88 bird casualties at power lines in North Dakota during 1978 and 1979 included 27 ducks (10 species), 16 American Coots, 11 Snow Geese, 3 Whistling Swan, 3 White Pelicans, 2 Swainson's Hawks, 2 Snowy Owls, 1 Golden Eagle, 1 Bald Eagle, and 1 Sandhill Crane. Most of the casualties were found at small distribution lines (40) or steel tower transmission lines (35). Wetland areas were associated with 71 of the 88 casualties. (See also Cernohous 1978 for earlier results of this survey.)

1029. U.S. Nuclear Regulatory Commission. 1975. Environmental statement related to operation of Davis-Besse nuclear power station unit. NUREG-75/097.

A total of 157 birds, mostly warblers and kinglets, was killed by colliding with the cooling tower of this Ohio power plant during the migration seasons of 1972 and 1973. In fall 1974, 342 casualties were recorded (281 at the coooling tower), including 53 Golden-crowned Kinglets, 39 Magnolia Warblers, 38 Ruby-crowned Kinglets, 2 red bats, and 1 eastern pipistrel bat. Scavengers may have removed considerable numbers of dead birds prior to collection. A list of casualties is given for each of the fall seasons 1972-1974. (See also Rybak et al. 1973 and Williams et al. 1975a.)

1030. Vickery, P. D. 1978. The fall migration: northeastern maritime region. Am. Birds 32(2):174-180.

Under foggy conditions, about 50,000 warblers were observed circling the lighthouse on Machias Seal Island on the night of 18 September 1977. The following morning, 554 dead birds, mostly Common Yellowthroats, were recovered.

1031. Walkinshaw, L. R. 1976. A Kirtland's Warbler life history. Am. Birds 30(3):773-774.

A male Kirtland's Warbler, banded as a nestling on 2 July 1971, struck a window and was killed on 27 September 1975 in Ohio.

1032. Webster, B. 1979. New lights-out policies save the lives of migrating birds. New York Times, 16 April:B6.

Following the recommendation of the National Audubon Society, for the past several years the floodlights on the Empire State Building have been extinguished on overcast nights during the spring and fall migration periods. This has resulted in the elimination of massive kills of migrating birds at this structure. The most recent recorded major incident there occurred in fall 1970 when at least 400 birds died on an overcast night. (The author's statement that the U.S. Fish and Wildlife Service conducted a survey in July 1978 that listed every recorded case and location of bird losses from colliding with structures in the U.S. is misleading because he was actually referring to the 1978 version of this annotated bibliography.)

1033. Webster, F. S., Jr. 1979. The autumn migration: south Texas region. Am. Birds 33(2):193-195.

A rainy period during 7-8 October 1978 was likely responsible for a kill of several hundred birds at a TV tower at La Feria in Cameron Co. The kill was discovered on 14 October, and it was impossible to determine the exact magnitude of the kill because coyotes had thoroughly scavenged the area.

1034. Welles, M. 1978. TV tower kill at Elmira. Kingbird 28(3):159-161.

The bird mortality during 20-24 September 1977 at the WSYE TV tower, Elimira, N.Y., is documented. Weather during the period was rainy with low cloud ceilings. Daily kill totals for the five dates were 1817, 1358, 375, 132, and 180, respectively. Total losses numbered 3862 birds of 44 species. Many more birds were killed but were not recoverable from fields and wooded areas surrounding the tower which is supported by 30 guy wires. Other carcasses were taken by crows. Bay-breasted Warblers (1226), Tennessee Warblers (375), Magnolia Warblers (326), Ovenbirds (311), and Swainson's Thrushes (218) were the most numerous species. A Syracuse, N.Y. tower reported reduced losses following the installation of two telephone relay towers nearby.

1035. Wiese, J. H. 1979. A study of the reproductive biology of herons, egrets, and ibis nesting on Pea Patch Island, Delaware; final interpretive report. Delmarva Power and Light Co., Wilmington, Del. 255 pp.

The results from the final year (1 March - 28 October 1978) of a 4-year study on the effects of a 500 kV transmission line across the Delaware River on the Pea Patch Island heronry are presented. Although the study concentrated on the effects to the reproductive biology of the wading birds in the heronry, an evaluation of the collision hazard was also made. During 6 hours of observing waders as they returned to the island in the evening, no collisions or near misses with the 500 kV line were noted. Virtually all birds flew below the line. However, five injured or dead gulls were found on the island indicating that gulls may occasionally strike the line. No dead birds were found under portions of the line searched during monthly walking surveys. At a second site north of the 500 kV line, waders were observed as they crossed a power line network consisting of a 138 kV wooden pole line, a 12 kV wooden pole line, and a 138/230 kV steel pole line. In 1978, waders were involved in several conductor collisions and numerous near misses at the 138/230 kV line. The multi-level conductor configuration at this line presented a problem to the birds in contrast to the single-level conductors which were crossed with little hesitation. Waders that entered the maze of wires of the 138/230 kV line in windy conditions were surrounded by conductors, became disoriented, and flared. Nearly all of the wader-conductor collisions resulted from flaring behavior. No dead or injured birds were found beneath these lines and no immediate fatal collisions were observed. Walking surveys beneath 1 km of 12 kV distribution line (wooden pole, three conductors) that crosses ponds and marshes at the Little Creek Wildlife Refuge, Del. revealed no carcasses in 1978. At this site in 1977, one adult Snowy Egret with a fractured wing was found beneath the line. In 1976, three Great Blue Herons were found below the wires, apparently killed by collisions, and two Great Blue Herons and one Great Egret were found hanging on the conductors, electrocuted. In general, wading birds approaching and crossing power lines appeared highly cognizant of the obstacles and typically changed flight speed, altitude, or direction of approach when flying at conductor heights. Such responses depended primarily on wind speed and direction relative to their flight paths, and on the height and configuration of the power lines. The presence and operation of the 500 kV power line was judged not likely to adversely affect the stability of the Pea Patch Island heronry or the nesting success of the wading birds therein.

1036. Willard, D. E. 1978. The impact of transmission lines on birds (and vice versa). Pages 3-7 in M. L. Avery, ed. Impacts of transmission lines on birds in flight. U.S. Fish Wildl. Serv. FWS/OBS-78/48.

In the keynote address to this workshop, the author presents a general overview of the bird-transmission line collision problem, and points out the distinction between the biological and political significance of such mortality. Several specific studies are mentioned and several recommendations are given: avoid ecologically sensitive areas and vulnerable species, and determine what it is worth to do so; reexamine the value of devices to increase the visibility of lines; control access to waterfowl areas with existing lines and control land use within 1 mile of new lines; study the electromagnetic effects of power lines on birds; assume no correlation between conductor size and collision potential; and accept dead bird studies with a degree of skepticism. Following this address, responses by two workshop participants are given.

1037. Williams, C. S. 1967. Honker - a discussion of the habits and needs of the largest of our Canada Geese. D. Van Nostrand Co., Inc. 179 pp.

A honker was killed by striking a high tension wire at Tulare Lake, Calif. Similar incidences involving wire fences, telephone lines, and trees are on record. At one location, 15 percent of the breeding geese autopsied had died of "mechanical injury."

1038. Wingate, D. B. 1964. Discovery of breeding Black-capped Petrels on Hispaniola. Auk 81:147-149.

One Black-capped Petrel was killed by striking a window in Haiti during summer 1957.

1039. Wood, M. 1979. Fall migration direction at a TV tower. Redstart 46(4):152.

On 10 mornings from 8 October to 8 November 1969, searches were made for dead birds at the 539 foot WPSX-TV tower in Clearfield Co., Pa. A total of 75 birds was found, with Brown Creepers, kinglets, and wood warblers being most numerous. Two red bats were also recorded. Foxes were suspected of removing some casualties.

1040. Wood, R., Senior biologist, Nebraska Game and Parks Commission. 1970. Letter to Paul F. Springer, Northern Prairie Wildlife Research Center, Jamestown, N. Dak. 16 September. 2 pp.

Bird losses at a 1500-foot TV tower near Bassett, Neb., were monitored sporadically. Relatively high losses of grebes and American Coots were noted, and a "fair number of rails and snipe" were also collected, as well as several ducks. Hundreds of "small birds" have been killed on a single night. No other details of the kill composition are given. The tower is situated in prairie pothole country, and greatest losses seem to occur in severe weather during fall migration.

1041. Woodward-Clyde Consultants. 1975. Three Mile Island nuclear station, unit 1 - terrestrial survey, semiannual report for 1974. 51 pp.

Searches for dead birds on and around the two natural draft cooling towers of unit 1 were conducted daily from plant start-up on 5 June 1974 though 30 June, and from 1 September through 30 November. Seven dead birds, including five kinglets, were found, all in October. During the preoperational period, 27 July 1973 - 4 June 1974, there were seven casualties at this unit, six of them kinglets.

1042. Woodward-Envicon, Inc. 1974. Three Mile Island nuclear station units 1 and 2 terrestrial environmental studies, preoperational survey, final report. Vol. 1.

The bases (out to a distance of 100 feet) of the four natural draft cooling towers at the Three Mile Island, Pa. site were searched for dead birds during the preoperational period 27 July 1973 - 4 June 1974. Searches were made daily during the spring and fall migration periods and twice weekly at other times. The 37 dead birds found during the study included 14 kinglets, 11 warblers and 10 vireos.

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